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ABSTRACT

The National Athletic Injury/Illness Reporting System (NAIRS) was established to serve as a system for continuous collection and interpretation of information on injuries and illnesses incurred by participants in sports. A description is given in this report of the genesis of NAIRS, its significance for athletic directors in conducting safe sports activities, and its methods of collecting and interpreting data. While NAIRS deals with many sports, this report presents data on and analyses of football injuries. Results of studies on the incidence, cause, and effect of football injuries are discussed. Statistics are reported on the kinds and severity of reported injuries sustained while using different makes and types of football helmets, and natural or artificial athletic field surfaces. (JD)

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The National Athletic Injury/Illness Reporting System (NAIRS)

An Epidemiological Examination of the Association of Selected Products with Related Injuries in Football 1975-1977

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FOREWORD

For efficient and effective injury control programs in sports, one needs data (1) to learn what injuries are occurring; (2) to learn what seems to influence the frequency of particular injuries; and (3) to learn the effects of countermeasures and other changes in the conduct of a sport.

For the above purposes, four kinds of data collection systems are needed: (1) Medical files at the local level which reveal and characterize the significant clinical concerns of the individual athletes; (2) Catastrophic injury reports at the national level which reveal and characterize the priority concerns within sport; (3) Surveillance systems which pool the essence of local medical files in a uniform manner to reveal and characterize significant concerns in a sport; and (4) Indepth investigations, which, with data collection controls and an endpoint specific to a particular hypothesis, can attend to significant concerns that surveillance data reveal but do not clarify.

Central to these efforts is the surveillance system which helps local institutions keep systematic medical files, helps give perspective to the catastrophic injury reports, and helps justify the more expensive indepth investigations while providing current relevant data at the end as well as at the onset of such studies.

NAIRS is a surveillance system created out of several workshops at which physicians, athletic trainers, and sports administrators shared their respective needs and limitations in obtaining such data. The experiences of previous attempts revealed both pitfalls and premises from which concensus was reached on critical input/output compromises.

One of the compromises included the recording of helmets and artificial surface experienced by the uninjured as well as injured players. To handle this data reasonably at the field level, efficiently at the administrator level, and meaningfully at the investigator level required a sizeable user population and complex computer software that could be operated by a utility programmer. Because The Consumer Product Safety Commission's National Electronic Injury Surveillance System was not sufficiently adequate for these purposes, contracts were awarded by CPSC to help NAIRS develop the very unique software which would give capability for handling product-related data via a surveillance system and to encourage a larger user population of the system. These goals were met, at least with football. In 1975 and 1976, NAIRS followed 55 and 45 teams, respectively, while in 1977, 101 schools and colleges completed a full season's reporting.

(NOTE: These numbers represent only those programs which completed all reporting requirements over the entire season. Data from programs which failed to comply completely were expunged from the data bank.)

In other product-related sports (e.g., gymnastics, ice hockey), the software was just as capable but the recruiting of voluntary use of the system was not as successful. Consequently, this report is devoted to the football data obtained to date. Gymnastics and ice hockey data were summarized for the CPSC in a separate report, with attention given to the implications for data analysis if sufficient use is realized. Details of the acquired computer software are also contained in the technical report.

This report honors those organizations who committed their support and grant resources to the development of NAIRS prior to the point when credibility was sufficiently visible to enable CPSC to award their contracts (see page 5-6). It is dedicated, moreover, to the many athletic trainers who accepted professionally the formidable task of data collection on a day-to-day basis to make the concept of a surveillance system a reality. Not only did many come to the front when asked, but the National Athletic Trainers Association endorsed NAIRS, and experiences and comments of the athletic trainers during its pilot stages gave validity to and confidence in the system.

This report, however, is not a final report. A surveillance system is a continuous system, and NAIRS will continue to examine injury patterns as long as sufficient support is given its capabilities. Further, analysis of the 1975-1977 data reported

herein will continue. As emphasized in the report, the necessity of analyzing the association of products with injuries on a bivariate basis does little justice to the probable interaction of various factors in the production of these injuries. Capability for sequential multivariate analysis of significant injuries will be realized within the year; in the interim, the current capability for examining the extent to which a single variable (e.g., brand and/or type of product) is associated with a particular injury will be exercised. Doing so, it was deemed necessary to take the reader as much through the premises of data interpretation as through the obtained data.

Kenneth S. Clarke, Ph.D.

Chairman, NAIRS Advisory Committee

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We would like to express sincere appreciation to a group of individuals who devoted considerable time and energy to this project. Their belief in the value of NAIRS made possible the data base which demonstrated that surveillance of athletic injuries through epidemiologic design is feasible. The athletic trainer and recorder have made a significant contribution to safety in sport.

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NATIONAL ATHLETIC INJURY/ILLNESS REPORTING SYSTEM

The National Athletic Injury/Illness Reporting System (NAIRS) was conceived in 1973 by Kenneth S. Clarke, Ph.D., and born in 1974 out of a series of three workshops supported in part by grants from The Pennsylvania State University, the National Collegiate Athletic Association, and the National Federation of State High School Associations, and in part by the organizations represented in the Advisory Committee. Out of these efforts NAIRS was conceived to serve as a practicable system for continuous collection and interpretation of information on injuries and illnesses incurred by male and female participants in a variety of sports. It was designed to establish trend-lines which would demonstrate the incidence of these health problems and the relative influence of a myriad of variables of preventive and hazardous character.

Products used by sport participants were among these variables. The limitations of the Consumer Product Safety Commission's National Electronic Injury Surveillance System (NEISS) with respect to organized sports, were not in terms of principle but in access and capability. The interinstitutional variation in management of sports injuries and the vagaries in defining sports injury and disability combined to warrant a mechanism based on the principle of NEISS but with an architecture directly related to the administration and supervision of sports.

SIGNIFICANCE OF NAIRS

Millions of Americans are participating in a variety of sports to obtain the assorted benefits associated with participation and training for participation. In doing so, they are accepting a reasonable risk of injury and assuming that those who govern and assist sport programs are using professionally defensible methods for keeping the risk reasonable.

Practitioners, institutions and national organizations with such responsibilities, however, face many decisions concerning sports safety problems with conflicting recommendations and without data to verify or refute respective contentions. Both the December 1972 Workshop on Injuries of Adolescents in Sport and Recreation (co-sponsored by the National Research Council and the American Academy of Orthopaedic Surgeons) and the February 1973 National Congress on Sports Safety (co-sponsored by the American Association for Health, Physical Education and Recreation, the Sports Medicine Foundation of America, and the USPHS Bureau of Community Environmental Management) affirmed that available sports injury data essentially were incomplete, obsolete, or uninterpretable.

The NAIRS system utilizes the philosophy and procedures of epidemiology in order to identify associations among variables which may influence the occurrence of injuries to male and female athletes. The appropriateness of surveillance research as an

epidemiologic technique is well established. Precedence for surveillance research in athletics is provided by another Consumer Product Safety Commission supported project conducted by Blyth and Mueller entitled, "An Epidemiological Survey of High School Football Injuries in North Carolina 1969-1972." (Contract #CPSC 7418)

OBJECTIVES

The objectives of NAIRS were seen as five-fold:

1. To provide a feasible and inexpensive mechanism for the continuous collection and retrieval of information concerning health problems in sports.

2. To provide a service to institutions and agencies for maintaining meaningful injury/illness records for a variety of sports.

3. To maintain a repository of nationally uniform current data for periodic epidemiological analysis.

4. To serve as a resource to decision-makers and qualified investigators for research-worthy information.

5. To investigate the relationship between sports equipment and safety.

To satisfy all its objectives, NAIRS was conceptualized as having three natures: (1) a composite of codings which capture the diversity of injury scenarios in sports for anyone to utilize in uniform manner, (2) a computerized system for processing an institution/agency's sport injury data routinely and meaningfully, and (3) a versatile facilitator for a variety of ancillary investigations by minimizing start-up costs and by providing current data bearing on the contentions of an investigator.

Also inherent in the plan was the self-sustaining data processing model developed by the Commission on Professional and Hospital Activities (CPHA), a non-profit organization with two decades of experience in handling hospital data. The key feature of this model was that each hospital received regular reports of its own experience plus reference to the average experience of all participating institutions.

NAIRS DEVELOPMENT

The outcome of the three 1974 Workshops was that the group concurred with the basic premises of the plan and agreed to serve as an Advisory Committee to NAIRS. The Joint Commission on Competitive Safeguards and Medical Aspects of Sports discontinued its impending committee activity along similar lines in favor of this plan.

Consensus was reached on all principal considerations, and support was given to Dr. Clarke for pursuing the funds necessary to bring the system and pilot year into operation. Needed in this regard were:

1. Systems analysis and ensuing computer programming to accommodate NAIRS' principles efficiently.

2. Medical terminology and other codings which would be appropriate for all levels of organizations and sports.

3. Forms and instructional guidebooks consistent with the data processing requirements, codes, and reasonable expectations of data access.

4. Certified athletic trainers willing and oriented to serve as NAIRS cluster coordinators for cooperating institutions.

5. A Work Conference for the Advisory Committee, District Coordinators, and consultants to review the prototype system and materials.

6. Staff to operate NAIRS at a central location.

By May 1974, the increasingly visible presence of NAIRS' details sustained continuing encouragement and cooperative support among the associated organizations. The National Sporting Goods Association offered to print the prototype forms as a donated service. The Pennsylvania State University's College of Health, Physical Education and Recreation authorized a change of the job description of its newly established athletic training education coordinator position to include NAIRS coordination as well, even though outside funding was not yet realized. Three weeks later at the National Athletic Trainers Association (NATA) Annual Convention, NAIRS was explained to NATA's Research Committee and to athletic trainers interested in volunteering to experience NAIRS in 1974-75.

During the 1974-75 school year sports injuries were reported voluntarily by athletic trainers in about 50 schools and colleges using the prototype forms and codes. In 1974 the National Federation of State High School Associations awarded a $5,000 grant for a graduate assistantship in Sports Safety research. Later in 1974, the Schutt Manufacturing Company granted $5000 to

begin the computerization process. In Spring 1975, the Amateur Hockey Association granted $2500 to assist NAIRS' development; the NCAA granted $2500 for studying Spring Football Practice Injuries; the ASTM-F8 Committee endorsed NAIRS. Inquiries on the nature of NAIRS began accumulating.

> NOTE: In late August 1974, federal legislation which called for a national survey of athletic injuries was signed into law as PL 93-380 (Sect 826). Dr. Clarke, NAIRS Director, was invited to HEW to attend a meeting on the requirements of this law and subsequently was offered the contract for the mandated study. However, the resulting HEW guidelines for the study precluded the use of NAIRS even in abridged fashion. The study was conducted covering the 1975-76 school year with Dr. Clarke contracted to receive and interpret the data.

In June 1975, supported by a $10,000 grant from the Sporting Goods Manufacturers Association for a graduate assistant and other office and keypunching costs, and by a $2500 grant from the National Sporting Goods Association for computer costs, Penn State agreed to continue sponsoring NAIRS in 1975-76. The NATA Board of Directors and the NFL Team Physicians were among those who added their endorsement of NAIRS, and the voluntary subscription to NAIRS doubled.

The basic elements within the original NAIRS conceptualization became operational during the 1975-76 school year. However, funds were needed for increased computer efficiency, and refinements of prototype forms and codes. A contract from the U. S. Consumer Product Safety Commission resulted in the organization of a central NAIRS staff and the refinement of capability within the computer operation. (contract #CPSC-76-0050)

NATURE OF NAIRS

NAIRS I

As a system, NAIRS has several identifiable versions. NAIRS-I serves as the optimal compromise between detailed surveillance input and output expectations for product-related data. Input is distributed over several types of forms and linked within the computer by identification numbers for school, athlete, and sport. Output thus required extensive computer software which could link the many variables within the forms in order to achieve output expectations.

All forms are the same regardless of sport followed. Most items require only a simple check of the relevant code option. Recorder Handbooks have been prepared to provide guidance concerning code options.

Institution Abstract. This form requests basic information on the size, resources, and sports offerings of the school. It is requested but once a year, preferably in the Fall. (Appendix A)

Participation Abstract. This form requests basic information on each athlete of a team being followed (e.g., age, year in school, experience). It is submitted once a season, preferably after the first official competitive event. (Appendix B)

Case Abstract. This form requests basic information on the nature of, and circumstances associated with, each reportable

injury or illness suffered by a participant, whether sport-related or not. This form is submitted within the week following determination of the athlete's date of return to participation. (Appendix C)

Weekly Transmittal Abstract. This form requests information concerning the number of practices and games conducted on different types of surfaces, plus the average squad size for practices and games, respectively. Submitted each week, this Abstract provides the occasion for forwarding completed Case Abstracts to preclude end-of-season recall pitfalls. (Appendix D)

Sport (Season Closeout) Abstract. This form requests basic information concerning the conduct of that sport, including the brand and type of helmets and shoes worn (if relevant). It is submitted once a season, immediately following the close of the competitive schedule to signify to NAIRS that all data for that season have been forwarded. (Appendix E)

Other Versions

NAIRS-II is an abridged selection of NAIRS-I codes and does not contain product-related information. The Institution Abstract is utilized, but the remainder of the data are recorded on a single form submitted once a month, on which each reportable case had been logged as it occurred. (Appendix F) Participating institutions may select either NAIRS-I OR NAIRS-II for each sport it chooses to record. NAIRS-II data can be merged with NAIRS-I data for collective analysis.

NAIRS-III is essentially identical to NAIRS-I except that the codes and forms are customized for one particular sport (NAIRS-I has a generic base for following a variety of sports in a common manner). NAIRS-III data also can be merged with NAIRS-I and NAIRS-II data for selective analysis. Currently NAIRS-III is only being used by professional teams in order to focus on variables of specific interest to the participating teams.

NAIRS-IV is currently in the conceptualization phase. This version will be an epidemiological adaptation to follow health problems of all students in an educational institution.

The NAIRS-V version was developed and piloted in the Spring of 1977. The adaptation is designed to meet the needs of the medical clinics which deal with sport related injury. It was designed, as with other NAIRS versions, through interdisciplinary planning between NAIRS, physicians, clinical and hospital staff personnel. This version began with a grant from the Seattle Sports Medicine Clinic and is now self supporting. (Appendix G)

NAIRS FEATURES

One key concept underlying NAIRS is that institutions are encouraged to utilize the Recording System for enhancement of their own health care system, and by so doing to contribute to a nationally uniform data base. Consequently, the capability of the system for research must be accompanied by the capability for

prompt and inexpensive service. This concept enjoins the research component to a useful application of the findings for decision making purposes at the institutional level and that of a sports governance body (e.g., rules committee).

Case Reports

Each month, institutional members receive a computer printout of each of the cases that have been processed for that institution during the previous month. On it are the codes that were indicated on the case report submitted by the recorder as well as the meanings of each of these codes translated by the computer. (Appendix H) This feature provides the recorder with file copies of each reported case plus systematic description of each injury regardless of individual or sport. It also offers the recorder the opportunity to review each case he/she submitted and indicate to NAIRS inaccuracies due to oversight or processing errors. If corrections are necessary editing is initiated and a corrected copy of the case is submitted to the recorder after the next update. Only this type of two way communication can provide the institution with accurate records while at the same time foster accuracy in the entire data base.

Monthly Reports

In addition to the case report, each recorder receives a Monthly Summary Table for each sport being reported. (Appendix I) This table displays both the injury rates for the individual team and the corresponding average rate for all teams of that

sport and level of play. New in 1977 was the inclusion of the case rate/1000 athlete-exposures as well as coefficient of variation for these rates. The data in this table provide the opportunity for the recorder to relate his/her experiences to that of the entire data base for that sport. Since sport seasons have a duration longer than one month, the data routinely returned on Monthly Summary Table 1 serve as a tentative indicator until the season has been thoroughly closed out for all participating teams.

End of Season Summary

At the end of each sport season, the data for that sport are manually and machine edited for the End of Season Summary. In addition to Monthly Summary Table 1, the end of season material includes four additional tables which portray various perspectives of the significant injury records for each institution as well as the entire data base. These tables include data for "game-related" "body part" by "position" (Appendix J), "game-related" "situation" by "body part" (Appendix K), "season-related" "body part" by "activity" (Appendix L), and "season related" "injury condition" by "activity" (Appendix M). Built into the programming for these tables is the option to select any occasion related category or disability classification along with any combination of variables from the NAIRS abstracts. (e.g., an institution may like to know how its injury experience compares to its conference

as a whole.) Overall, these tables offer the convenience of seasonal injury patterns shortly after the season's end. The cost efficiency of these features is made possible by the unique sport sensitive computer software which, in a single pass of the data file, permits the production of summary information for all sports and levels of play within NAIRS.

Ad Hoc Inquiries

Each subscribing institution has the opportunity to carry out its own investigation of the recorded data. NAIRS computer programs are designed to be able to tabulate data in a variety of ways. Tables 2-5 (Appendix J-M) demonstrate a few standard ways of presenting data. Any variable within the NAIRS system can be placed on either axis of these bivariate tables and frequencies, percentages and rates/1000 athlete-exposure can be developed. These tables also include selection criteria for games, practices, diagnoses, sports, levels of play, and severity.

Members are encouraged to ask questions concerning the data within their program. Through an understanding of data the enthusiasm of the institution will be reinforced and thereby foster continuing membership. For a member to participate for one year provides only frequency considerations of injuries incurred by that team in that season. But to participate over several years provides the team with data extremely useful in identifying areas of their program which may persistently produce

injury rates that exceed the average for the system. This institutional concern for data analysis will produce data that are meaningful for the members as well as the entire system.

Product Related Inquiries

Within the design of the NAIRS-I system are variables which can be used to consider product related injuries. The Case Abstract (Appendix C) includes such items as surface when stricken, protection of body part injured and equipment being used at the time of injury. These areas allow NAIRS to analyze factors such as type of helmet being used when a concussion occurs, the type of shoe being worn and the type of surface when ankle and knee injuries occur, or the type of mouth piece being worn at the time of dental injury. In addition to the type of equipment, the manufacturer of the equipment is recorded along with its vintage. From these data, frequency associations can be analyzed for the presence of patterns which seem to be associated with injury.

By combining equipment exposure data from the Sport Season Closeout (Appendix E) and the team exposure data recorded in the Weekly Abstract (Appendix D), the patterns of association between products and injury can be identified and standardized into rate calculations (e.g., cases/1000 athlete-exposures).

Definitions

NAIRS is founded on functional definitions which ensure uniformity through a common understanding of basic criteria.

1. REPORTABLE INJURY/ILLNESS: Injuries and illnesses meeting any of the following definitions are reportable. This means that a Case Abstract must be filed. These definitions are meant to separate the nuisance injuries which warrant little attention and do not materially affect decisions from the health problems which have potential or demonstrated significance.

   a) Any brain concussion causing cessation of the athlete's participation for observation before return to play is permitted is reportable.

   b) Any dental injury which should receive professional attention is reportable.

   c) Any injury/illness which causes cessation of an athlete's customary participation throughout the participation-day following day of onset is reportable.

   d) Any injury/illness which requires substantive professional attention before the athlete's return to participation is permitted is reportable (i.e., without such attention, the athlete would not have been permitted to return to participation the next participation-day).

   NOTE: Any program has the privilege of reporting any injury/illness under liberal interpretation of this definition.

2. PARTICIPANT (ATHLETE): An "athlete" is defined by the type of program in which the patient was involved when stricken. For NAIRS-I and II, an athlete is one who maintains candidacy for varsity competition by subscribing regularly to the team's eligibility rules, procedures, and scheduled activities.

3. PARTICIPATION (RETURN TO PARTICIPATION): An athlete is "participating" if he/she has health supervisory clearance or coach permission to engage in activities generally expected of his/her teammates.

4. PRACTICE (PARTICIPATION-DAY): Only those coach-directed sessions which include supervised physical activity are recordable practices.

Severity Classifications

Beyond the reportability of injury or illness, and central to interpretation of the data, is the significance given a particular episode. In this regard, NAIRS utilizes primarily a functional orientation: time loss from effective participation in sport. Clinical information is sought concerning each episode as well. Specifically, the following degrees of severity were adopted to give optimal clarity to the epidemiological data being obtained.

Minor. The distinction between a MINOR and a SIGNIFICANT injury is the most pivotal of the premises adopted. A MINOR injury constitutes a reportable injury/illness which did not

prevent the athlete from returning to an effective participation capability within one week from the day of onset. For routine reports regarding the incidence and prevalence of sports injuries, minor injuries will be excluded. Such problems do not reflect meaningfully on the calculated risk of sport participation. For analytic purposes, however, the reportable injury/illness proving to be of only MINOR significance remains in the data bank for ad hoc reference and for use if that injury recurs or is followed by a significant complication.

Significant. Injuries/illnesses which exceed the criterion of MINOR become SIGNIFICANT events. Significant injuries include all injuries with time loss greater than seven days. An exception is made for dental injuries which may not cause absence for a week. Any dental injury which is MINOR in terms of lost time is computer-converted to SIGNIFICANT. Within the SIGNIFICANT category, injuries permitting the athlete to return to participation within eight to twenty-one days are termed MODERATE. Inability to return to participation within 21 days from onset is the criterion used by NAIRS for assigning MAJOR status to a health problem. This recognizes that any problem which prevents a highly motivated participant from being active in sport for at least three weeks, regardless of mode of treatment, is a major problem.

Severe. To avoid overinterpretation of the word MAJOR by those reviewing data reports, a fourth severity classification, SEVERE, is utilized for the type of permanently disabling injury of societal significance (e.g., death, quadriplegia, amputation, brain damage).

Athlete Exposure

For epidemiological purposes, it is necessary to express frequency of injury as rates. Usually, this has been expressed as the number of cases experienced per standard population size (e.g., 5 injuries/100 athletes). This represents the relative frequency of a particular injury so that one can compare the finding with other populations and/or seasons. However, a more representative relative frequency of injury includes the frequency with which the athletes are exposed to the potential of injury (i.e., athlete-exposure). An athlete-exposure is each opportunity for an athlete to get hurt (e.g., 50 athletes at 5 practices equal 250 injury opportunities or 250 athlete-exposures). More precise calculations of exposures are possible and often desirable for particular indepth investigations; but, for surveillance purposes, the athlete-exposure concept suffices as an index for epidemiological comparisons.

Along with new case reports, NAIRS Recorders forward weekly information on athlete-exposures in games and practices, respectively; designation of playing surface is included within this information

for analysis of injury patterns on different types of surfaces. The computer combines this information with that of injuries incurred, and selected associated variables to arrive at injury rates per 1000 athlete-exposures.

On Sampling and the Representativeness of Data

Since this report is devoted to principles of meaningful data interpretation, with selected data obtained over the first three years of NAIRS' development, it is appropriate to comment on the process called "sampling." To do so, it is necessary to return to the criteria for "meaningful" data and the nature of this report.

To be meaningful, data must be decision-worthy. That is, data should help a decision-maker (e.g., consumer) select from alternatives for a particular action or task. Data may help a consumer determine that a choice between existing alternatives must be made on a basis other than the particular contention at hand. Discerning consumers often find relevant data in hand to be inadequate (unreliable, nonspecific, inaccurate, obsolete, incomplete, and/or biased). Yet, decisions must be made, with decision-makers considering the representativeness of the available data to the alternatives requiring a decision.

The workshops and pilot years of NAIRS dealt specifically with the representativeness of the data being sought for respective sports in terms of reliability, specificity, accuracy,

currency, and completeness on the least costly surveillance basis. The earlier sections of this report described procedures and criteria utilized successfully to satisfy the limits of compromise between output and input expectations. However, provisions for controlling bias (i.e., via epidemiological and sampling requirements) have been only partially implemented to date.

Epidemiologically, control over the potential bias of disproportionate exposures was built into the input and output capability of NAIRS so that rates of injury could reflect the number of injuries associated with the number of opportunities to be injured. Products such as helmets and artificial surfaces were included within this design capability. For example, if Helmet A were found to be associated more with significant head injuries than Helmet B, then this would be based on the number of athletes who were not injured while wearing the Helmet A compared to Helmet B as well as those injured while wearing the helmets.

The sampling process, properly done, however, permits the investigator to generalize from data which are representative of the persons in the study to a larger population from which these persons were obtained. It also may serve to satisfy underlying premises for applying some parametric statistical techniques to the data. The key requirement for sampling is equal opportunity for every person in the population of interest to have been

included. Sampling becomes more significant the smaller the proportion of the persons being studied is compared to the population about which one wants to generalize, because the possibility for inadvertent bias in the sample is increased.

The problem of sampling concerns both over- and under-reliance on the sampling process as an index of representativeness for ensuing generalizations. For example, the Consumer Product Safety Commission's National Electronic Injury Surveillance System (NEISS) utilizes a national sample of over a hundred hospital emergency departments for its data, yet its extrapolations for skiing would not be as accurate as for other injuries because these hospitals were not sampled to represent national exposure to that unique activity. A second example is HEW's National Athletic Injury Study which constituted the first truly national sample of high schools and colleges for the reporting of sports injuries, yet which sacrificed other dimensions of "meaningfulness" in the data to stay within the budget of that project.

The principal study with a sizable population for yielding meaningful data concerning the relationships of sports injuries to protective equipment was the "North Carolina Study." It followed epidemiologically the injury experience of a sample of 43 high school football teams in North Carolina from 1969 through 1977 using indepth investigative technique. Even the North Carolina

Study has been overinterpreted by some (e.g., application of findings to collegiate football). Technically, without due caution, generalizations exceeding North Carolina high schools or even current years within North Carolina would be overinterpreted.

This typifies the need for discernment among consumers as to the value of sampling in context with other requirements of representativeness affecting the value of available data. The degree to which the population about which one wants to generalize is probably similar to the study population with respect to the characteristics of interest is critical. For example, in the North Carolina Study, the relationship of the coaches' characteristics to the injuries experienced would not be as generalizable outside North Carolina high schools as would be the relationship of the helmet to the injuries experienced.

There is general agreement among researchers with regard to one sampling premise. A tremendous variation exists in injury experience from team to team, and for a given team from year to year. The study population therefore, regardless of sampling protocol, must be sufficiently sizable and followed long enough, to learn what experiences are representative of that sport.

NAIRS has been unable to incorporate the advantages of a formal sampling process to date. In the absence of funds to give incentive, it has been relying on voluntary use of the system while building its desired capabilities. As such, the opportunity for participation in NAIRS was available to every high

school and college in the nation (i.e., had equal opportunity to participate). Whether a selection factor for NAIRS participation introduced a systematic bias is subject to question. At the NAIRS staff level, the perceived motivating forces behind institutional participation was highly variable. While an institutional commitment to an athletic training/team physician support program usually was present, to suggest on that basis that these teams have fewer injuries or different injuries than teams who chose not to utilize NAIRS would be conjecture. Also, while a core of teams spanned all three years of NAIRS data to date (e.g., Big Ten), a good number within each year's totals represented turnover in teams as well as widespread geographical distribution.

Further, it became very apparent at the onset that non-compliance with the requirements of the system would result from involuntary selection, and a well designed sampling process with rampant noncompliance would yield less representative data than the convenience sample of voluntary users.

NAIRS is a multisport system with schools and colleges following from one to twenty-six sports; to ensure that each sport followed is a result of a random sampling process is logistically a most challenging task. Sampling will be done in the future either when school/college commitment is assured within the population to be sampled or when the volunteer user population is large enough to permit sampling from within.

With the preceding as preface, NAIRS data in this report have been interpreted without parametric tests and may be characterized better as generalizations on injury-related products than on product-related injuries. The NAIRS three-year football population of 16,000 athletes and well over a million athlete-exposures, predominantly from NCAA Division I teams, is a most sizable population in itself, with highly consistent overall injury rates from year to year despite changes in the user population. Illustrations of hypotheses which bear on football per se (as opposed to contentions subject to differing characteristics within certain football populations) are thus examined by this population, with five epidemiological tests (pages 30-31) for a cause-effect relationship being applied.

DATA DISPLAY

Of all the alternatives available for displaying injury data, preference is given to the circumstances and degree of severity that best fit the decision-oriented discussion that sought the data. For example, game-related rates depict experiences when all teams are participating at equal intensity; in practices, some teams scrimmage and have contact drills more often than others. On the other hand, some concerns warrant a picture of the total experience of a season, including practices.

As for degrees of severity, one should work backward in interest and priority attention from the most severe to the least

severe injuries. The Severe injury is much more profound than a Major injury, yet even the Moderate injury is significant to the athlete and team because at least one competition was missed. The "Reportable" injury tables, which reveal the influence of the minor injury on injury patterns, are included as well, for perspective. However, the minor injury is subject to inconsistent reportability, receives considerable variation in medical management, and is thereby to a substantial extent uninterpretable. Further, if it proved to be only "minor," an injury may be philosophically "accepted" as inevitable in an arena of contact and/or maximum effort between equally motivated athletes. Preventive measures should be focused on patterns of significant injury.

For this report, attention will be given to two combinations of circumstance (game-related and total season) with priority attention given to the significant injury.

FOOTBALL INJURIES: PREMISES FOR ANALYSIS

The sport of football is an activity which generates much discussion and concern for the safety of participants. Because of the collision nature of the game, participants must recognize that injuries are likely to occur. The important questions which need to be answered are, "What is the risk of sustaining a football related injury?", and "Is there anything which can be done to effectively reduce this risk"? This section of the report provides perspective for data tables which quantify the risk.

Table 1 portrays high school and college football participation in NAIRS during the 1975-1977 seasons. Participation was on a voluntary basis generated only by the commitment of these programs to the purpose of NAIRS (i.e., with no monies coming from NAIRS to give incentive). As noted earlier in this report, NAIRS is a surveillance system, available in a product related version (NAIRS-I) and an abridged non-product related version (NAIRS-II). NAIRS-I football recording occurs predominantly among the college teams while most high schools utilize NAIRS-II. In assessing the overall risk of injury for football, both versions may be combined since they use a common coding system. Product-related tables, however, must be confined to NAIRS-I programs. Where appropriate, the tables merge high school and college data.

Table 1 reveals that football participants under NAIRS surveillance have accumulated more than 1.3 million athlete-exposures from 1975-1977. Most of the exposure (1.1 million) occurred among NAIRS-I college teams. This number of exposures provides advantageous opportunity to observe patterns associated with commonly occuring football injuries. If the injuries of interest are rare, however, even a million exposures may not be adequate to identify patterns of association for interpretation.

Table 2 presents the average exposure for high school and college football teams and athletes to the opportunity of injury. The three year total column reveals that a high school team experiences about half the exposures per season as a college team. The individual high school athlete experiences about 10 fewer exposures per season than the college football player. The greater college team exposure thus is a function of more participants and a longer season.

In this section of the report, rates are usually expressed as cases per 1000 athlete-exposures. During a season, college teams average 7600 exposures. To determine the number of specific injuries that a college team might expect during the course of a season, the injury rate multiplied by 7.6 would provide the expected frequency. Similarly, high school teams averaged about 4000 exposures per season. To ascertain the expected frequency for a particular injury during a season, the injury rate would have to be multiplied by 4.0. It takes a college team about two seasons and a high school team about three seasons to accumulate 1000 game-related athlete-exposures.

Table 3 offers a cross-sectional distribution of NAIRS colleges by NCAA Division I, II, and III status. The NAIRS population is predominantly Division I for all three years. Divisions II and III are represented and display a gradual increase in membership with each year of use. This is

perceived as being a positive shift since a more representative picture of college football injuries is likely to result from greater distribution among the nation's colleges.

Incidence of Injury

Table 4 presents the variety of rates that can be used to standardize the frequency of injury. Incidence rates provide a measure of the rate at which people become ill or injured within a specified population and during a specified period of time. Incidence rates are important because they provide a basis for statements about the probability of sustaining an injury. Comparison of incidence rates among populations which vary in one or more factors, enables statements about whether or not the factor in question affects the risk, and if so, the magnitude of effect for the chosen variable.

Each of the rates presented in Table 4 offer a separate perspective on the same data. This is helpful since alternatives in presenting rates provide more meaningful responses to particular questions than the use of but one rate calculation. For instance, the total case rate per 100 athletes answers the question of how many injuries (cases) occur for each 100 athletes participating in high school or college football. The case rate per 100 athletes playing college football in 1977, for example, was 91.5. This means that nearly 92 injuries, representing all degrees of severity, occurred for each 100 athletes.

The athlete rate per 100 athletes, on the other hand, indicates the number of injured athletes per 100 participants. Table 4 demonstrates that in 1977 approximately one-half of the NAIRS college football players suffered a reportable injury. By comparing the 1977 total case rate per 100 athletes (91.5) and the total athlete rate per 100 athletes (52.3), it is apparent that many athletes incur more than one injury during the season. In this instance, the probability of an athlete receiving a reportable injury is found to be substantially different from the probability of reportable injuries being experienced among the athletes.

By examining the significant athlete rate per 100 athletes (Table 4), it is observed that significant injuries were sustained by approximately one-fourth of the college football players. By comparing the significant case rate per 100 athletes in 1977 (24.6) and the significant athlete rate per 100 athletes (23.0) it is interesting to note that if a college football player receives a significant injury, he is not likely to receive another significant injury during the same season. This appears to be true for each of the three years.

The case rate per 1000 athlete-exposures presented in Table 4 is the most often used rate in this report. This rate indicates the probability of selected injuries for each 1000 football exposures (games x number of athletes in games + practices x number of

athletes in practices). According to the data in this table, a college football team can expect about 11 reportable injuries for each 1000 athlete-exposures and three significant injuries for each 1000 athlete-exposures.

Another comment in reference to Table 4 relates to the NAIRS objective to establish injury rate patterns and trends. This is important since a pattern must demonstrate year to year persistence in order for statements of association to be warranted and year to year change if new factors of influence are hypothesized. If, for example, the injury rates per 1000 athlete-exposures for each of the three years were calculated to be 3, 45, and 18, it would be misleading to make interpretations based upon data from a single year. This is not the case for Table 4. Each of the rates for college football show a remarkable degree of persistence from year to year. High school rates show more variability from year to year, a phenomenon probably attributable to the fewer total exposures available to determine the rates.

Concurrently, if the injury rates per 1000 athlete-exposures for respective teams were calculated to be 3, 45 and 18, it would be misleading to make interpretations based upon data from a single team. This is the case for NAIRS teams. Hidden within the persistent means is a wide range of injury rate experiences among the respective teams.

The Cause-Effect Premise

Football brings to each participant a complex of forces and experiences (beneficial as well as hazardous) which continuously generate assertions of cause and effect for decision-makers in sport to ponder. Various investigative procedures have utility for examining particular cause-effect propositions within the etiology of a problem. Biomechanical, physiological and clinical inquiries can bring definitive analysis of the hypothesized mechanism which bridges a causal factor and its consequence. Epidemiological inquiry, on the other hand, analyzes the degree to which an item (i.e. hypothesized causal factor) is associated with an outcome (i.e., the consequence). While epidemiology can only reflect on mechanisms bridging cause and effect, its advantage is its feasibility for surveillance of both items and outcomes within a population during ambient conditions of life.

The cause-effect premise for epidemiological studies is that it is not sufficient to show only an association of the item (e.g., helmet) with the outcome (e.g., concussion) to conclude that the item caused the outcome. Rather, epidemiological data can only reflect on the inverse of the cause-effect proposition: while an association of two variables does not in itself prove that one causes the other, a hypothesis that one causes the other requires at least a substantial and persistent association of the two variables to justify further consideration. Even though other interacting variables may influence the

rate of occurrence, the influence of a variable which indeed constitutes a focal mechanism of injury will be discernible.

To examine particular contentions of cause-effect against the basic cause-effect premise with epidemiological data, five tests are to be applied:

1. The frequency of the opportunity for the alleged agent or mechanism to cause the injury must be ascertained (e.g., would a defective football helmet design, if present, be tested frequently or rarely?).
2. The frequency of the injury associated with the alleged mechanism of injury must be ascertained (e.g., is the outcome of concern experienced frequently or rarely?).
3. The difference in injury rate between those who are exposed to the alleged mechanism and those who are not must be ascertained and found to be "substantial" (e.g., do those who wear a particular helmet have a significantly higher head injury rate than those who wear a different helmet?).
4. The "substantially high" injury rate associated with the alleged mechanism, if found, must be a persistent finding, from year to year and among populations similarly exposed, in correlation with the opportunity for the design defect to be demonstrated.
5. The "substantially high and persistent" injury rate associated with an alleged mechanism, if found, must be reasonably independent of the influence of associated factors which also may be causative agents.

The Critical Interval Criterion

Evaluating differences between two rates as "substantial" or not on an objective basis is a troublesome task. One custom is the calculation of percent differences between rates. If the difference between two rates was 2.0, for example, a set of low rates (3.0, 5.0) would represent a 67% percent increase; a set of higher rates with the same difference (23.0, 25.0) would represent a relatively negligible percent difference (9%).

Another illustration of such vagaries would be the increase of a rate from 3.0 to 6.0 in consecutive years, for a "100% increase." Yet, if the rate returned to 3.0 the following year, it would be only a 50% decrease; the two-year net is a 50% increase with no change in rates. It is the net difference that must be evaluated, but as a net difference.

Essential to the examination of the cause-effect premise thus is a valid characterization of significant difference. Hopefully one can turn to a statistical test to assess the difference between two findings. More fundamental, however, and too often totally ignored is the interval between two rates which indeed makes a difference. For example, a concocted fluid may be promoted as entering the bloodstream significantly faster than other fluids to help prevent heat illness. To judge the merits of this obtained difference, it would be necessary first to determine the interval on the continuum of time which indeed

does make a difference in preventing heat illness. Then, if a study reveals that the interval had been met, one may apply a suitable statistical significance test to determine the degree to which this could be accounted for by chance.

The injury tolerance level of "how much is too much?" remains a personal value judgement. The critical interval criterion is no different. However, "how much difference is there?" should be subjected to objective measurements and a criterion understandable to the type of consumer decision found in football. Assuming one helmet has a higher rate of concussions associated with it than another nationally, the athletic director would like to know the net difference in actual concussions on his squad that these rates represent.

Table 5 was developed to display the net intervals between rates required to make a difference of one, two, or three injuries per team per season. Referring to the column, "Combined" which will be applicable for the ensuing tables on head and neck injury rates, if a football injury rate is expressed in terms of cases/1000 athlete-exposures over the total season, the net difference between rates must reach 0.3 for a helmet to be associated with an additional two injuries if an entire team wore these helmets over a season.

Solutions which are aimed at the problem of injury reduction are costly in terms of time (it takes more than one season to learn whether subsequent injury patterns proved the purported

solution to have been a solution), money (some solutions require infusion of monies, some the abandonment of existing financial investments), and attention (by pursuing one solution, one may be inadvertently overlooking a true or better solution). The criterion of clearly greater than one additional injury per season per team, therefore, was adopted as the minimum critical interval for a consumer oriented difference between football injury rates. Further, to satisfy the test of persistence this interval must be reached each year of use.

This minimum interval does not necessarily demonstrate an imminent hazard; it represents a minimum test required for a consumer to consider this observed characteristic within his/her selection process. Less an interval could be attributable to normal fluctuations in experience and/or to coincidental associations other than mere brand and model of helmet (e.g., helmet condition, technique and style of offense or defense, previous neurotrauma, etc.). Less an interval with persistence from a larger population, however, should be examined for statistical and clinical significance.

Because catastrophic injuries are rare, distinct patterns of association would not necessarily meet this interval criterion. The first of the five tests of cause-effect (page 30-31) would have to be re-examined for a more refined assessment of exposure in a season to the alleged agent of injury.

Statistical Significance

The critical interval criterion provides meaning to the difference observed in the relative frequency of injury among various factors. Once this criterion has been utilized, the determination of statistical significance is useful in examining the differences between the observed number of injuries and a theoretical expected value based on probabilistic calculations. In other words, how much of the difference between the observed frequency of injury and the theoretical expected frequency is attributable to chance alone?

To establish statistical significance a variety of models are available depending on the characteristics of the data to be analyzed.

The most useful of these models for analysis of "count data" (e.g. sports injury frequency) in bivariate tables (one variable vs. another variable) is a non-parametric model known as Chi-Square. It is used both for determining the significance of differences in proportions and the degree of independent variation among variables. Parametric models are also available, but their underlying premises, at present, preclude their applicability to the surveillance data being used in this analysis. Multivariate models are being examined which will honor the complex interactions of many factors in the onset of an injury. Pages 7-8 reflect the many factors recorded for NAIRS which can be examined.

Essentially, by Fall of 1979, contentions such as those presented herein could be subjected to the following sequence of analysis:

1. Application of a loglinear multivariate model which uses "count data," accommodates exposure-related variables, and is probabilistic.

2. Application of a cluster analysis model, conducted independently of the previous step, to distinguish the various clustering of variables associated with a particular injury (there may be several persistent scenarios accompanying the onset of knee injuries).

3. Reapplication of the loglinear multivariate model for each cluster to determine the relative strength of the variables independently and by interaction with the respective others.

In the interim, this report utilizes the Chi-Square model to examine the bivariate difference in proportion of the injured vs. the un-injured under the same conditions. The assumptions inherent in the use of this model are that the variables under examination are independent of each other, and that the first four of the five epidemiological tests (pages 30-31) can be so examined. The Null Hypothesis then states that under independence the proportion of injured to un-injured for factor A is equal to a similar proportion for factor B. The procedure is to test this hypothesis by comparing the observed and expected frequencies to the standard chi-square distribution.

With NAIRS data, the observed frequency of injury is recorded by the participating institutions. In addition, the number of exposures under various conditions (see page 17 for discussion of athlete exposure) are reported. By the NAIRS definition, an athlete-exposure is an opportunity to be injured. Therefore, each opportunity has only two possible outcomes i.e., injury or no injury. The denominator in the observed proportion is derived by subtracting the number of injuries from the number of exposures under specific conditions.

The Chi-Square model is particularly applicable to NAIRS data since the underlying sample and/or population distributions are unknown. However, it should be noted that beyond the bivariate limitation the calculated chi-square value has a potential limitation. If the expected frequency for cells within the table become equal to or less than five, the validity of the chi-square value is questionable and other interpretive techniques may be employed. In this report the Yates Correction for Continuity is used when the expected frequency falls below five. The use of this technique, for 2 x 2 contingency tables, partially compensates for the discrepancy that exists when small discrete frequencies are used to approximate the continuous chi-square distribution. This supports the need for a large population to produce the required data base.

Examination of the data within this report will utilize both the critical interval criterion for the difference that one, two or three additional injuries would make in the overall rate consideration and the statistical significance value obtained from the Chi-Square.

FINDINGS -- Helmets

Using the data obtained during the first three operational years of NAIRS to illustrate these principles of data interpretation, two common allegations of cause-effect associated with football helmets can be examined against the five tests described on pages 30-31:

Head-Related: That a helmet may be causing craniocerebral injuries in football to its wearers by failing to perform as expected (i.e., an inherent design weakness leaves the wearer vulnerable to the impacts of football collisions).

Neck-Related: That a helmet may be causing cervical spinal cord injuries in football to its wearers by its posterior edge impinging on the cervical spine during forced hyperextension (i.e., an inherent design feature constitutes a direct hazard leaving the wearer vulnerable to customary forces of football).

Test 1: Opportunity for Injury

The data displayed in Table 6 are offered to provide a conceptualization of the possible number of the impacts to the helmeted head in a single season. The reviewer can substitute

his/her own preferred assumptions. There is no question, however, but that there is "ample opportunity" for the helmets being worn by football players to reveal design defects or inadequacies from the impacts with opponents and turf each season (a motorcyclist may never test the performance of his/her helmet).

Explanation of two assumptions used in Table 6 is warranted. HEW's national study of athletic injuries (in press) found 15,743 secondary schools and colleges to be offering football; the 20,000 estimate acknowledges the additional unknown number of junior high teams whose athletes, if receiving a fatal injury, would appear in the Annual Football Fatality Report. The 1:12.4 ratio of game athlete-exposures to practice athlete-exposures was taken directly from NAIRS data on exposures; the estimated 1:10 ratio of helmet hits, game to practice, acknowledges less hitting per person per practice period than in a game, but more athletes hitting per practice period than in a game.

Test 2: Frequency of Neurotrauma

The nature of the contentions being examined in this report permit the pooling of high school and college populations to achieve the largest possible opportunity for neurotrauma. Tables 7 and 8 display the respective frequencies of cerebral neurotrauma and cervical fracture per 100 athletes. Table 7 reveals a very stable (year to year) relatively low frequency of cerebral

neurotrauma in football. Roughly 95 out of a 100 athletes did not experience even a minor concussion despite the "ample opportunity" for such. Further, the relative frequency of concussion dropped by a factor of ten when confined to significant concussions (995 out of 1000 athletes were spared this experience), and another factor of ten under game conditions for the major concussion (9995 out of 10000 athletes were so spared). No skull fracture or permanent serious brain damage was reported among the 16,090 athletes followed in the first three years of this study.

It is apparent that these football helmets as a whole were performing quite effectively, whether one considers a concussion a helmet performance failure by having permitted a concussion to be experienced, or a helmet performance success by having dissipated a profound impact force so that "only" a temporary concussion was experienced at worst.

Table 8 reveals an extremely low frequency of cervical fractures over the first three years of NAIRS. Further, at least half of these were diagnosed as avulsion fractures which result from a mechanism other than impingement and are not a threat to the spinal cord. This is evidenced by the presence of athletes with cervical spine fractures who were permitted to return to play within three weeks of the injury. One case of quadriplegia was experienced; this was described as a hyperflexion injury, which is not consistent with the alleged "karate chop" mechanism.

With such small observed frequencies, chi-square analysis could not be applied. Yet it is apparent with respect to the cervical spine injury as well as to concussions that helmets as a whole were not associated with serious neurotrauma among these athletes.

Tests 3 & 4: Helmet vs Helmet

Even though neurotrauma is an infrequent occurrence in football it is desirable to look within the injured population to determine whether a particular helmet is associated with neurotrauma more than would be expected. It is now time to return to the critical interval criterion. Is there objective evidence that the infrequency of neurotrauma in football could be even more infrequent if a particular helmet was no longer utilized?

Tables 9, 10, 11 were prepared to provide perspective to concussion rates for the first three years of data by helmet worn and helmet exposure. Under each helmet is the rate of concussions by those wearing the helmet, the actual number of cases experienced while wearing this helmet, and the percent of the population that year wearing this helmet. In Table 9, Helmet #1 displayed a rate of 0.1 significant concussions for every 1000 athlete-exposures over the 1975 season during which that helmet had been worn. Reading downward, a total of three significant concussions had been experienced while wearing that helmet, and 7.5% of the athletes in the sample had worn that helmet.

The thirteen helmets identified in these tables represent eight manufacturers and most of the models worn with a regular frequency. Rates which exceed the average for all helmets with less than three cases experienced should be ignored; the increase in rate accompanying each case would be too disproportionate to interpret fairly. In Table 10, for example, Helmet #12 nearly exceeded the interval of one additional injury in 1976 with but one case, an artifact of very small proportionate use of that helmet.

Table 11 presents the inclusion of minor injuries among the thirteen different helmets under game situation. The data yielded a greater degree of variation than the succeeding two tables which dealt only with significant injuries. Upon close examination, the rates for Helmet #1 showed persistently lower rates by one or two injuries than Helmet #3 and the same is true when comparing Helmet #10 and #3. Even though the test of persistence is met, the relationship between #1 and #3 shows a statistical significance level in one year only ($p < .01$, 1975) when the injured-non-injured proportion is subjected to chi-square analysis. When comparing Helmets #10 and #3 the chi-square value does not demonstrate a statistically significant difference at the .05 level for any of the three years. Overall, the three tables show no helmet associated with more than its share of neurotrauma when using the tests of persistence, critical interval, and statistical significance.

Tables 12 and 13 were developed to provide perspective in the analysis of cervical fractures by helmet relatedness. As previously discussed, a sizable proportion of these fractures were of a diagnosis reportedly not related to the concern of neurotrauma, yet all were kept in Table 12 for this report.

These tables are presented in terms of the manufacturer, not type of helmet; the shell configuration does not vary within a brand. Rates of 100,000 athlete-exposures had to be used because of the infrequency of these occurrences. While the extremely small expected frequencies precluded use of chi-square analysis, it is apparent that no helmet was revealed as being unduly associated with cervical fractures.

FINDINGS -- Playing Surface

Another current controversy in football is whether or not artificial surfaces contribute an additional significant risk of injury. The three primary contentions focus on surface hardness, friction, and shoe-turf interface. The issue of hardness was examined by comparing concussion rates for natural grass and artifical surfaces. Abrasions were used to compare injury differences due to surface friction. Similarly, meniscus/knee sprains and ankle sprains were chosen to analyze the issue of shoe-turf interface (great toe and foot sprain data are also presented, even though their frequency of occurrence is considerably smaller).

The following portion of this report deals with selected injuries and the associated playing surfaces. The overall frequency of one such injury, the concussion, is displayed in Table 7. Additionally the meniscus/knee sprains category and the ankle sprains are discussed. The frequencies of these types of injuries for the entire NAIRS I & II data base are found in Tables 14 and 15.

NOTE: The category meniscus/knee sprain includes injuries about the knee. Because of the nature of the association between meniscus injuries and ligament sprains, both are considered together.

Table 14 displays the frequency of meniscus/knee sprains for college football 1975-1977. It can be observed that the case rate/100 athletes remains quite constant for each of the severity categories for each of the three years. Future seasons are needed to judge whether the slight tendency toward increased rates persist, especially under game conditions.

An additional analysis which should be mentioned involves surgical procedures of the knee. Over the three years, 324 football related knee surgeries were reported to NAIRS from College Football. The frequency represents 0.3 per 1000 athlete-exposures. Of the total, 144 occurred from game related exposure (1.7 per 1000 athlete-exposures). On the average, college football in the NAIRS system sustained about two knee surgeries per team-season.

It was interesting to note that the rate of surgical knees within the population was relatively constant from year to year per 100 athletes (1975: 2.8; 1976: 1.9; 1977: 2.4). The data presented here represent only one type of medical management, with

no attempt to identify the causes which led to injuries requiring surgery. A more complete analysis of knee injuries will be developed through the use of multivariate statistical techniques. A below knee amputation which resulted from a knee dislocation in 1975 represents the only severe injury recorded for the lower extremity.

Table 15 displays similar rates for ankle sprains as for reportable meniscus/knee sprains, but the rates for significant ankle sprains are about half that of significant meniscus/knee sprains.

The rationale for testing the cause-effect premise as previously presented in the discussion related to helmets is followed. For this discussion, college data only were utilized; the high school teams using NAIRS played rarely on an artificial surface.

Tables 16 and 17 display the college football athlete-exposures for each of four surfaces. The total three year exposure for NAIRS-I college football is different from the figure presented in Table 4 due to the more than 7,000 exposures which were recorded on surfaces other than natural grass, Astroturf, Tartanturf, and Polyturf (e.g., indoor gymnasium floor). Since the exposure on polyturf represented less than one percent of the total exposure, the analysis of surface related contentions was limited to natural grass, Astroturf, and Tartanturf. Table 17 presents the proportion of exposure for these three surfaces. The percent-exposure is fairly consistent over the three years

with natural grass (including Prescription Athletic Turf) accounting for 59 percent of the athlete-exposure; Astroturf 31 percent; and Tartanturf 10 percent.

Tables 18 to 31 display injury rates bearing on the three surface-related cause-effect contentions. The reader is reminded that analysis priority be given to those tables delimited to significant injuries. The overall rates for some selected categories of injury are fairly low on each of the playing surfaces, so it is necessary to examine both the rate and the number of injuries producing the rate. When both the absolute frequency of occurrence is low, and the amount of exposure is low, a single added injury would so dramatically influence the rate that the perspective could change substantially.

To clarify, Tables 21-23 return to the critical interval concept and chi-square analysis validation for interpreting observed differences in injury rates. The reader is reminded that Table 6 provides the difference needed between two rates to account for an additional one, two, or three injuries per team per season.

Surface Hardness

Cerebral concussion was used as an index to analyze the contention that artificial surfaces are harder than natural grass, thereby creating an excessive risk of injury. Significant concussions were relatively infrequent events, yet the rates did not vary considerably between surfaces (Tables 18-19, 21-22).

The incidence of game-related reportable concussions is more substantial, and Tables 20 and 22 reveal fairly constant and similar year to year rates for each surface. Also demonstrated by comparing Tables 22 and 23 are the vagaries of including minor injuries and a relatively low number of exposures. For two of the three years in each, Tartanturf is associated with either two more or two fewer concussions per team-season than is grass; yet in neither do the differences reach statistical significance.

Friction

By the customary criterion of lost time, abrasions are seldom reportable injuries. Of those reported under game conditions (Table 20), no surface was found to be associated significantly with those occurrences. Only two significant abrasions were reported during the three years to date and only two cases indicated secondary infection as a complication of an abrasion type injury.

Further analysis identified the elbow and forearm as receiving half of the abrasions. It is logical to surmise that athletes are more apt to be wearing protective equipment designed to prevent such abrasions when playing on artificial surface. It is apparent, following this logic that this preventive action is effective.

Shoe-Surface Interface

Tables 18 to 20 also present the rates for those injuries considered to be a function of the shoe-surface interface. Rates

for meniscus/knee sprains and ankle sprains are fairly consistent within each playing surface for each of the three years of recording. Both the level of opportunity and frequency of occurrence for these injuries are considered to be sufficient for analytical purposes.

Each of the tables of meniscus/knee and ankle sprains shows a slightly higher rate for Astroturf and for Tartanturf than natural grass; but for significant injuries, only Tartanturf approaches satisfaction of the critical interval test, persistence, and chi-square analysis. It is therefore appropriate to introduce here the fifth epidemiological test to assess the possibility that these findings are spurious -- that is, this observed association of Tartanturf with significant lower extremity sprains may be explainable by the coincidence of other interacting variables. As discussed earlier in this report, the appropriate multivariate analysis model which is being developed would provide the desired examination of the relationship of surface to the many variables which could be of influence. At present, several factors representative of the fifth test were selected for bivariate attention: shoes, age of surface, familiarity with surface.

Shoe and Surface Differences. Sprains at the lower leg, for example, may be a function of a type of shoe interfacing with the surface instead of or in addition to the surface alone. Tables 24-26 provide the rates for ankle sprains by shoe type on each of the three playing surfaces. Tables 27-29 offer the data for meniscus/knee sprains by shoe type and surface. These six tables

fail to establish any patterns or trends of persistent differences in terms of shoe type. Because of the variability of rates from season to season, no statement on association is warranted.

Surface age and surface differences. The second factor to be examined in the series was the impact the age of the playing surface may have on the obtained meniscus/knee and ankle sprain surface-related frequencies. NAIRS coding of artificial surfaces included a designation of "New" and "Old". New surfaces are those which are in their first three years of use, and "Old" refers to surfaces that are greater than three years old. Tables 33 and 34 display data collected for meniscus/knee sprains and ankle sprains on Old and New artificial surface under game conditions. Game conditions were selected because it is certain that the entire session was played on one surface whereas practice conditions could vary from surface to surface for some institutions.

As these data are examined it should be noted that the Tartanturf exposures present an uncertainty in interpretation in this regard. The last Tartanturf to be installed within the NAIRS population was completed in August of 1973 (the last surface nationwide was installed in October 1973). Only about 300 Tartanturf game exposures were played on a New Tartanturf occuring in the 1975 football season. In addition, some members of the NAIRS recording population had new "rugs" installed over existing padding. These surfaces were listed by recorders as

"New". At stake in analyzing old and new Tartanturf then, is the definition of a truly "new" Tartanturf. If new Tartanturf is considered to be based on the age of the rug, the relationships shown in Tables 31 and 32 are accurate. If, the designation of the "new" classification for Tartanturf is dependent upon the age of padding and not the rug, then all but a few of the NAIRS Tartanturf exposures would be classified as "old" Tartanturf.

Table 32 represents the difference between rates of injury when old turf is used as the standard and new surface rates are compared to old surface rates. These data indicate that some differences appear for Tartanturf; however, no persistent relationship is observed, and only additional years of data will establish specific trends. In 1979, more sensitivity to this factor will be gained by defining "Old" as greater than 5 years use, giving a new label to the four-to-five year category.

Familiarity and surface differences. To complete the picture of surface consideration, a third factor was examined. "What differences exist in meniscus/knee and ankle sprains for athletes on their home game surface compared to their away game surfaces?" Tables 35 through 40 display the differences as home and away contests are compared for natural grass, Astroturf and Tartanturf. As the critical intervals are analyzed for each of the three years, consistent differences were observed for Tartanturf and for reportable ankle sprain on both artificial surfaces. Yet, when chi-square analysis was applied, many of these observed

differences were found not to be statistically significant. This tendency toward away game differences, whether significant or not, is sufficiently associated with the differences found between Tartanturf and grass for lower extremity sprains to reflect the hazards in relying on bivariate analysis for cause-effect questions.

Shoe Types and Respective Surfaces

Table 30 offers data on significant meniscus/knee sprains by specific shoe on artifical surface. Astroturf and Tartanturf are combined since teams playing on artifical surface usually use the same shoes for any artificial surface. The thirteen shoes analyzed represent about 90 percent of NAIRS total college football exposure on artifical surface. The remaining 18 shoes found in the NAIRS college population account for approximately ten percent of the exposure. It should be noted that Shoe #2 accounts for more than half the exposures on artificial surface during 1976 and 1977. The rate of injury for this shoe does not vary considerably from year to year. The variability of rates among the other shoes evidently is a function of low exposure. With the exception of shoe number two, the data do not permit generalization or statements of relative risk.

NOTE: Effective Fall 1978, the "multicleat" shoe was recoded into three types to provide more sensitivity to the surveillance of shoeturf associations with lower extremity injuries.

Table 31 displays the rates of particular shoes on natural surface. On grass, twelve shoes represent about 90 percent of the total exposure. There is a more even distribution among these shoes because most exposure on natural surface occurs with standard cleats. It should be pointed out that direct comparison between Tables 30 and 31 is not possible since the identification numbers for the shoes listed in Table 30 do not correspond with the same shoes in Table 31.

Since the distribution of shoe type on natural grass shows three cleat configurations (standard, soccer and multicleat) being worn, these shoes were examined by chi-square analysis in order to determine if the assumption of independence was violated. Assuming that standard cleats are the norm for use on natural grass, Table 32 shows no persistent critical interval difference for soccer versus standard and multicleat versus standard. In addition, when the proportions were examined, only those noted were found to meet the statistical significant level of .05. From the data, it is not possible to generalize that one type of cleat configuration is superior to another in terms of injury-relatedness on grass surfaces.

SUMMARY AND CONCLUSIONS

The National Athletic Injury/Illness Reporting System (NAIRS) was conceived in 1974 for the continuous awareness of trends of injury patterns in sport and the factors, products included, identified with them. A multiple-form system for distributing the burden of collecting needed information, it required only conscientious commitment at the field supervision level for participation. An epidemiologically oriented system, it relied nearly as much upon information concerning the uninjured in the participating population as upon the injured.

The purposes of this CPSC contract were to enhance efficient computer capability for editing and retrieving high volume product-related injury data and to increase the utilization of this capability by those who sponsor sport programs. With respect to football, both purposes were met. The number of high school and college teams followed by NAIRS over the Fall 1977 season doubled that in Fall 1976 and Fall 1975. The computer software was improved to permit on an overnight basis both customized outputs monthly to each participating team and ad hoc multivariable outputs as warranted, with only utility programming skills required.

The purpose of this report is to reflect this capability via the development of premises for interpreting product-related

injury data within a surveillance system, followed by the examination of selected data obtained over NAIRS' first three years of operation. Selected for examination was the sport of football with its currently relevant product-related issues concerning helmets and artificial surfaces.

Of all the sports to be followed on a surveillance and product-related basis, football posed the most rigorous requirements for the recorder. Squad size exceeded 100 for a number of the teams, and reportable injuries were relatively frequent. Yet, only a small proportion (less than 5%) of those who voluntarily began a season did not fully complete the season with NAIRS. Since these years were associated with the vagaries of getting started and teams were geographically distributed over the entire country, the feasibility of such a system with commitment to uniformity on a national basis was demonstrated.

For selected analytic purposes, the current level of participation among football teams has utility. While the population was not randomly selected, the opportunity for participation was available to every high school and college team in the nation. It is not known whether a common self-selection factor was operating, and if so, whether it could influence the data in a common manner; however, systematic bias has not been observed. In addition, the sample size, total athlete exposures, geographic distribution and universal availability tend to offset the limitations of a non-random population.

Nonetheless, interpretation was limited to nonparametric measures. Stipulated contentions circulating in sport would not seem to be subject to a self-selection bias in substance. That is, for example, while NAIRS data cannot as yet with confidence predict which helmet is better than another, it is capable of supporting or rebutting an allegation that a given helmet, because of a deficiency inherent to its design, is a cause of significant neurotrauma for whomever wears it.

To approach these concerns, careful scrutiny was given to input and output criteria. Central to these were the use of "athlete exposures" as the denominator of injury rates and the differing degrees of severity of the injuries experienced to give perspective to the significance of these occurrences. Priority was given the designation of "significant" (sport disability for greater than one week), although the opportunity to express these injuries by other designations was not sacrificed.

Special attention was given the cogent question of "cause-effect" concerning product-related injuries. A series of five epidemiologic tests were advanced which would be applicable to such surveillance data as available from NAIRS. Key among these tests was the critical interval test, "How much of a difference makes a difference?" For the purpose of this study, the critical interval was determined as the difference between rates of injury which would constitute a difference of at least one additional

injury per team over a season. Subsequently, an appropriate statistical test was applied to see to what extent the difference could be explained by chance alone.

Other tests included an assessment of the opportunity for the alleged mechanisms of injury to be operating and the persistence of a relevant finding on a year to year basis.

The last of the tests, multivariate scrutiny of the influence of a given product, could not be demonstrated in this report. The necessity at present to resort to a series of bivariate analyses for interpreting a product's association with selected injuries tends to perpetuate satisfaction with the simplistic argument of a single cause for a single effect in the complexity of sport. However, display of the data in hand permits demonstration of the first four tests of cause-effect and hopefully hints at the inadequacy of bivariate analyses in responding to cause-effect questions. As indicated in the Foreword of this report, this is not a final report. Current as well as future data will soon be applied to sequential multivariate analyses which will honor more representatively whatever interactions there are among the various factors which could be influencing etiology, frequency, and/or severity of significant injury/illness concerns in sport.

While chi-square and multivariate analyses are generally familiar concepts, the preceding critical interval test and subsequent persistence test are not. Neither of these tools replace

statistical significance tests; in combination, they provide an index of meaning to the difference being evaluated in terms of unit of measurement considered valid for the study's goals and of the cause-effect premise with epidemiological data.

Extrapolation which strays from the degree of severity defined by the injury data and from the study population from which the data were obtained requires caution. Patterns of minor injury are not necessarily mimicked by significant or major injuries. Further, the study population's athlete-exposures essentially reflect the college scene, not high school. The critical interval is larger in high school due to fewer athlete-exposures per season (Tables 2 and 5). While there are 16 times the number of high school football teams than college, it cannot be determined from this report's data the proportionate use of the respective helmets among the high school population.

Because of the relative infrequency of significant injuries in football, even this size population was found to be only marginally sufficient to examine other than null hypotheses, especially as analyses required third and fourth level breakdowns of the data (e.g., artificial surface to Astroturf and Tartanturf to home versus away to reportable versus signficant injuries). Nonetheless, by broader categories (e.g., significant injuries, concussions, knee sprains), the injury rates were surprisingly uniform over the three years and probably represented quite reasonably the general injury picture at the college level,

especially for Division I teams. Conversely, it was also clear that on a team by team basis, the injury picture was highly variable; without a national average, one would not know which team most closely resembled the national picture.

Contentions commonly circulating about the cause-effect status of helmets and artifical surface were examined by utilizing the stipulated premises and selected data obtained by NAIRS over the 1975, 1976, and 1977 football seasons.

Helmets

On the stipulated premise that "ample opportunity" existed for a defective design within current football helmets to reveal its hazardous nature, this sample and its three years of records were sufficient to refute contentions that any of the helmets in frequent use constitute an imminent hazard for serious brain damage or quadriplegia in football. Further, with respect to the helmets worn by only a small proportion of the population, the evidence to date does not support such contentions of cause-effect. Nonetheless, the surveillance of these injuries and associated helmets will continue, as will further searches for patterns adhering to neurotrauma.

Because of the relative rarity of catastrophic injuries, this sample is far too small to examine the pattern of associated factors that may be accompanying those that do occur. Only those studies designed to obtain all such catastrophic injuries nationally,

or a known and substantial proportion of such injuries, would present interpretable information of patterns which could lead to specific preventive measures of catastrophic injuries. However, a catastrophic injury is only one degree of severity related to a particular etiological mechanism. A decision-worthy understanding of a mechanism, therefore, will emerge best from studies or reviews interrelating catastrophic cases with injuries of lesser yet significant consequence.

Analysis through multivariate statistical techniques, for instance of severity of concussion by helmet type and playing surface, would necessitate even more exposures than are currently stored within the NAIRS computer. This points to the need for a larger sample for the national surveillance of significant injuries if the data are to be usable for a variety of decision-making purposes.

Surface

Statements have been made to the effect that artifical surfaces contribute substantially to the risk of injury. These contentions were classified by the respective mechanisms of injury alleged to be operating. Artificial surface was expressed by brand: Astroturf and Tartanturf.

One of the primary concerns about artificial surface was that the hardness of the surface contributes to excessive rates of injury. Concussions were examined as a likely index of this

allegation. The data in this study do not support this notion on either artificial surface. Artificial turf may feel or be harder upon impact than natural grass, but it does not even tend to be associated unduly with significant injuries reflecting hardness of surface.

Another contention is that artificial surfaces have a greater amount of friction upon impact than natural surfaces. Again there may be a greater amount of friction on artificial turf, but it has not been demonstrated that this is an important uncontrollable safety hazard. The data reveal only two significant and 12 reportable abrasions recorded for both artificial surfaces during three years of study. Apparently, with proper protective apparel for the upper extremity, abrasions do not constitute a major concern on the natural or artificial surface.

The final contention, that artificial surface contributes unduly to football injuries, concerned the shoe-turf relationship reflected by sprains to the lower extremity. In this instance, both artificial surfaces showed a tendency yet not conclusive association with lower extremity sprains if minor injuries were included. Limited to significant injuries, a less conclusive picture was revealed for Astroturf, and if limited only to significant sprains under game conditions which depicted equivalent intensity among all teams, only Tartanturf remained associated with significant differences (albeit not persistently each year).

Because of these findings, the fifth epidemiological test for cause-effect was approached by a series of related bivariate analyses in lieu of multivariate analysis. The capability for such analysis is in progress. First, the relationship of shoe type (i.e., by cleat configuration) by type of artificial surface revealed no differences. In fact, a substantial proportion of the shoes worn on artificial surfaces were "multicleats," and this precluded much opportunity to observe differences. Effective Fall 1978, "multicleat" has been further categorized into three groupings by number of cleats to permit more sensitivity to this concern. (Analyses of lower extremity injuries by shoe type on natural grass revealed no significant differences as well.)

Second, since Tartanturf is no longer marketed, it seemed reasonable to hypothesize that the higher rates associated with Tartanturf may be attributable to an influence of the age of the product. Consequently, the injury rates by age of surface were examined (new = first three years of use; old = older than "new") with inconclusive results. Effective in Fall 1979, more sensitivity will be given this factor by adding a third category of age (e.g., greater than five years of use).

The final examination in this series of bivariate analyses of significant lower extremity sprains was of the home/away schedule. It seemed logical to consider that nonfamiliarity with a surface may be a contributing influence; away games, in contrast

with home game experiences, would reflect advantageously on this. The findings were paradoxical as to this direction with respect to Tartanturf and not always to the satisfaction of tests for statistical significance.

Collectively, these findings will receive priority attention when capability for sequential multivariate analysis becomes a reality.

Implications

The system has demonstrated that consistent recording among a large number of teams is feasible for meaningful surveillance data. It has taken three years to refine the original concept under field conditions and with enough count data (injuries) to begin a reliable descriptive analysis of selected interests. For multivariate analysis, the partitioning of cells requires massive input. For many contentions, it is estimated that a minimum of 100 teams, preferably 200, would be needed to accurately portray the strength of association among variables in a given sport. With at least 50 teams, the cause-effect question can be approached. For rare events such as cervical fracture, only a national repository would suffice. For the privilege of generalizing results of injury patterns at the high school level, it is preferred that a random sampling process be utilized to obtain a study population.

TABLE 1
TOTAL FOOTBALL EXPOSURE
HIGH SCHOOL AND COLLEGE
1975-1977 (NAIRS I & II)

	1975			1976			1977			1975-1977 Total		
	H.S.	College	Total	H.S.	College	Total	H.S.	College	Total	H.S.	College	Total
Teams												
NAIRS I & II	13	42	55	8	37	45	32	69	101	53	148	201
NAIRS I	12	41	53	4	37	41	11	68	79	27	146	173
Participants												
NAIRS I & II												
Season	650	3738	4388	360	3330	3690	1664	6348	8012	267	13416	16090
Game	533	2226	2759	288	1813	2101	1024	3381	4405	1845	7420	9265
NAIRS I												
Season	600	3640	4249	176	3330	3506	572	6256	6828	1348	13235	14583
Game	492	2173	2665	140	1813	1953	352	3332	3684	984	7318	8302
Total Athlete-Exposures												
NAIRS I & II	46646	310286	356932	27139	275502	302641	129726	531798	661471	203511	1117586	1321097
NAIRS I	43058	303899	345957	13409	275502	288911	47238	526477	573633	103705	1104878	1208583

TABLE 2
AVERAGE ATHLETE-EXPOSURES,
BY TEAM AND ATHLETE
HIGH SCHOOL AND COLLEGE FOOTBALL
1975-1977 (NAIRS I & II)

	1975		1976		1977		3-Year Average		
	H.S.	College	H.S.	College	H.S.	College	H.S.	College	Combined
TEAMS									
Average Practice Exposure/Team	3131	6791	3038	6957	3778	7200	3608	7067	6101
Average Game Exposure/Team	432	576	351	526	312	539	347	561	501
Total Sport Exposure/Team	3563	7367	3389	7483	4090	7739	3955	7628	6602
ATHLETES									
Average Number of Practices/Athlete	63	76	68	77	78	78	69	77	76
Average Number of Games/Athlete	10	11	10	11	10	11	10	11	10
Total Exposure/ Athlete	73	87	78	88	88	89	79	88	86

TABLE 3
COLLEGE FOOTBALL PARTICIPATION BY NCAA DIVISION
1975-1977 (NAIRS I & II)

	1975	1976	1977	1975-1977
DIVISION I	23	25	45	93
DIVISION II	11	7	10	28
DIVISION III	7	4	11	22
(CANADIAN)	(1)	(1)	(3)	(5)
TOTAL	42	37	69	148

TABLE 4
INJURY RATES
HIGH SCHOOL AND COLLEGE FOOTBALL
1975-1977 (NAIRS I & II)

	High School			College		
	1975	1976	1977	1975	1976	1977
Programs	13	8	32	42	37	69
Athletes	650	360	1664	3738	3330	6348
Total Case Rate Per 100 Athletes	50.5	81.3	63.4	97.7	93.2	91.3
Significant Case Rate Per 100 Athletes	14.5	24.4	16.7	26.2	24.8	24.6
Total Case Rate Per 1000 AE*	7.0	10.5	8.1	11.7	11.2	10.9
Significant Case Rate Per 1000 AE*	2.0	3.2	2.1	3.2	3.0	2.9
Total Athlete Rate Per 100 Athletes	32.5	29.4	40.9	55.1	58.2	52.3
Sig/Athlete Rate Per 100 Athletes	19.8	14.3	15.6	23.7	22.1	23.0

*AE = Athlete Exposures

TABLE 5
DIFFERENCES REQUIRED BETWEEN
RATES TO "SAVE" ONE, TWO, OR THREE INJURIES
PER TEAM IN ONE FOOTBALL SEASON

	H.S.	College	Combined
SEASON RATES			
One Person /1000AE	0.3	0.2	0.2
Two Persons /1,000AE	0.5	0.3	0.3
Three Persons /1,000AE	0.8	0.4	0.5
GAME-RELATED RATES			
One Person /1000AE	2.9	1.8	2.0
Two Persons /1,000AE	5.7	3.6	4.0
Three Persons /1,000AE	8.6	5.4	6.0

TABLE 6
CURSORY NATIONAL ESTIMATE OF HELMET CONTACTS
IN A SEASON OF FOOTBALL
ASSUMPTIONS & CALCULATIONS

1.	Plays/Game	170
2.	Helmet Hits/Play/Team	5
3.	Helmet Hits/Game/Team	850
4.	Helmet Hits/Season Team (Games)	8500
5.	Calculated Ratio of Game Exposures to Practice Exposures	1:12.4
6.	Estimated Ratio of Helmet Hits (Games) to Helmet Hits (Practices)	1:10
7.	Helmet Hits/Season/Team (Practices)	85000
8.	Total Helmet Hits/Season/Team	93500
9.	Football Teams Nationally	20000
10.	Total Helmet Hits/Season/Nation	1.9 billion

TABLE 7
FREQUENCY OF CONCUSSIONS BY SEVERITY
HIGH SCHOOL AND COLLEGE FOOTBALL
1975-1977 (NAIRS I & II)

	Total Season							Game-Related						
	Reportable		Significant		Major		Severe	Reportable		Significant		Major		Severe
	N	R*	N	R	N	R	N	N	R	N	R	N	R	N
1975	235	5.4	25	0.6	10	0.2	0	115	4.2	9	0.3	1	0.0	0
1976	229	6.2	24	0.7	3	0.1	0	111	5.3	9	0.4	1	0.1	0
1977	441	5.5	47	0.6	8	0.1	0	223	5.1	20	0.5	2	0.1	0
3 Yrs.	905	5.4	96	0.6	21	0.1	0	449	4.9	38	0.4	4	0.04	0

*R = Cases per 100 athletes

TABLE 8
FREQUENCY OF CERVICAL FRACTURES
HIGH SCHOOL AND COLLEGE FOOTBALL
1975-1977 (NAIRS I & II)

	Total Season								Game-Related						
	Reportable		Significant		Major		Severe		Reportable		Significant		Major		Severe
	N	R*	N	R	N	R	N	R	N	R	N	R	N	R	N
1975	2	0.05	2	0.05	1	0.02	0	0.00	1	0.04	1	0.04	0	0.00	0
1976	4	0.11	2	0.05	2	0.05	1	0.03	1	0.05	0	0.00	0	0.00	0
1977	5	0.06	4	0.05	3	0.04	0	0.00	2	0.05	1	0.02	1	0.02	0
3 Yrs.	11	0.07	8	0.05	6	0.04	1	0.01	4	0.04	2	0.02	1	0.01	0

*R = Cases per 100 athletes

TABLE 9
SIGNIFICANT CONCUSSIONS, TOTAL SEASON
BY HELMET PER 1000 ATHLETE-EXPOSURES
HIGH SCHOOL AND COLLEGE FOOTBALL
1975-1977 (NAIRS I ONLY)

	All Helmets	Helmet: Type and Brand #1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13
Rate														
1975	0.1	0.1	0.1	0.1	0.1	0	0.0	0.0	0	0	0.1	0	0	0
1976	0.1	0.0	0.2	0.1	0.1	0	0	0.1	0	0.3	0.0	0	0.4	0
1977	0.1	0.1	0.1	0.0	0.1	0.1	0.2	0.1	0	0	0.0	0	0	0
3 Yrs.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0.1	0.0	0	0.1	0
Cases														
1975	25	3	7	1	11	0	1	1	0	0	1	0	0	0
1976	24	1	5	3	5	0	0	3	0	3	1	0	3	0
1977	43	3	7	2	8	2	4	15	0	0	1	0	0	0
3 Yrs.	92	7	19	6	24	2	5	19	0	3	3	0	3	0
% Use														
1975	100	7.5	28.8	3.3	22.4	0.1	8.3	6.9	3.8	3.9	4.1	0.1	5.0	0.2
1976	100	9.0	20.5	6.4	15.7	2.1	7.8	16.1	3.1	3.1	10.8	0.1	2.8	1.0
1977	100	4.6	20.0	15.8	10.5	4.6	3.3	29.3	2.8	1.8	4.4	0.2	0.0	0.5
3 Yrs.		6.5	22.7	9.9	15.2	2.7	5.8	19.7	3.2	2.7	5.9	0.1	2.1	0.5

TABLE 10
SIGNIFICANT CONCUSSIONS, GAME-RELATED
BY HELMET PER 1000 ATHLETE-EXPOSURES
HIGH SCHOOL AND COLLEGE FOOTBALL
1975-1977 (NAIRS I ONLY)

	All Helmets	Helmet: Type and Brand #1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13
Rate														
1975	0.3	0.4	0.6	0	0.3	0	0	0.5	0	0	0	0	0	0
1976	0.4	0.5	0.2	0	0.6	0	0	0.8	0	0	0	0	1.7	0
1977	0.4	1.0	0.5	0.2	0.2	0	1.9	0.5	0	0	0	0	0	0
3 Yrs.	0.4	0.6	0.5	0.1	0.4	0	0.4	0.6	0	0	0	0	0.6	0
Cases														
1975	9	1	5	0	2	0	0	1	0	0	0	0	0	0
1976	8	1	1	0	2	0	0	3	0	0	0	0	1	0
1977	16	2	4	1	1	0	2	6	0	0	0	0	0	0
3 Yrs.	33	4	10	1	5	0	2	10	0	0	0	0	1	0
% Use														
1975	100	8.2	27.7	3.1	21.7	0.1	7.6	7.1	5.9	3.2	4.6	0.1	4.1	0.3
1976	100	9.2	20.3	6.4	16.3	2.8	6.9	17.6	2.5	2.4	10.6	0.1	2.8	1.4
1977	100	5.2	19.9	14.9	11.2	5.3	2.6	29.0	3.0	1.8	4.6	0.1	0	0.5
3 Yrs.		7.1	22.5	9.1	15.8	3.0	5.4	19.3	3.8	2.4	6.0	0.1	2.0	0.6

TABLE 11
REPORTABLE CONCUSSIONS, GAME-RELATED
BY HELMET PER 1000 ATHLETE-EXPOSURES
HIGH SCHOOL AND COLLEGE FOOTBALL
1975-1977 (NAIRS I ONLY)

	All Helmets	Helmet: Type and Brand #1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13
Rate														
1975	4.0	1.7	4.0	8.9	5.1	54.1	1.3	4.4	0.0	1.1	6.7	0	6.8	0
1976	5.1	2.6	8.4	5.2	7.3	0.0	0.7	5.4	0.0	5.8	1.8	0	6.8	10.3
1977	5.0	3.9	5.0	6.8	3.2	2.9	5.7	5.2	8.3	7.2	3.8	0	0	0
3 Yrs.	4.7	2.7	5.7	6.7	5.0	3.0	2.1	5.2	2.9	4.2	3.7	0	6.8	5.3
Cases														
1975	116	4	39	8	32	2	3	9	0	1	9	0	8	0
1976	108	5	36	7	25	0	1	20	0	3	4	0	4	3
1977	196	8	39	40	14	6	6	60	10	5	7	0	0	0
3 Yrs.	420	17	114	55	71	8	10	89	10	9	20	0	12	3
% Use														
1975	100	8.2	27.7	3.1	21.7	0.1	7.9	7.1	5.9	3.2	4.6	0.1	4.1	0.4
1976	100	9.2	20.3	6.4	16.3	2.8	6.9	17.6	2.5	2.4	10.6	0.1	2.8	1.4
1977	100	5.2	19.9	14.9	11.2	5.3	2.6	29.0	3.0	1.8	4.6	0.1	0	0.5
3 Yrs.		7.1	22.5	9.1	15.8	3.0	5.4	19.3	3.8	2.4	6.0	0.1	2.0	0.6

TABLE 12
CERVICAL FRACTURES TOTAL SEASON
BY HELMET MANUFACTURER PER 100,000 ATHLETE-EXPOSURES
HIGH SCHOOL AND COLLEGE FOOTBALL
1975-1977 (NAIRS I & II)

	All Helmets	Helmet: #1	#2	#3	#4	#5	#6	#7
Rate								
1975	0.6	0.0	0.9	0.0	0.0	0.0	0.0	0.0
1976	1.4	0.0	1.9	3.2	0.0	0.0	0.0	0.0
1977	0.9	7.7	0.3	0.0	5.3	7.6	0.0	0.0
3 Yrs.	0.9	1.9	0.8	1.3	1.4	2.4	0.0	0.0
Cases								
1975	2	0	2	0	0	0	0	0
1976	4	0	3	1	0	0	0	0
1977	5	2	1	0	1	1	0	0
3 Yrs.	11	2	6	1	1	1	0	0
% Use								
1975	100	12.5	61.9	5.2	8.5	5.5	0.2	4.2
1976	100	11.9	55.4	11.0	7.8	3.4	2.2	6.5
1977	100	4.6	62.7	5.3	3.3	2.3	4.8	15.8
3 Yrs.		8.6	60.7	6.6	5.9	3.5	2.9	10.2

TABLE 13
MAJOR CERVICAL FRACTURES TOTAL SEASON
BY HELMET MANUFACTURER PER 100,000 ATHLETE-EXPOSURES
HIGH SCHOOL AND COLLEGE FOOTBALL
1975-1977 (NAIRS I & II)

	All Helmets	Helmet: #1	#2	#3	#4	#5	#6	#7
Rate								
1975	0.3	0.0	0.5	0.0	0.0	0.0	0.0	0.0
1976	0.7	0.0	1.3	0.0	0.0	0.0	0.0	0.0
1977	0.5	0.0	0.3	0.0	5.3	7.6	0.0	0.0
3 Yrs.	0.5	0.0	0.5	0.0	1.4	2.4	0.0	0.0
Cases								
1975	1	0	1	0	0	0	0	0
1976	2	0	2	0	0	0	0	0
1977	3	0	1	0	1	1	0	0
3 Yrs.	6	0	4	0	1	1	0	0
% Use								
1975	100	12.5	61.9	5.2	8.5	5.5	0.2	4.2
1976	100	11.9	55.4	11.0	7.8	3.4	2.2	6.5
1977	100	4.6	62.7	5.3	3.3	2.3	4.8	15.8
3 Yrs.		8.6	60.7	6.6	5.9	3.5	2.9	10.2

TABLE 14
FREQUENCY OF MENISCUS/KNEE SPRAINS
BY SEVERITY FOR COLLEGE FOOTBALL
1975-1977 (NAIRS I & II)

	Total Season								Game-Related							
	Reportable		Significant		Major		Severe		Reportable		Significant		Major		Severe	
	N	R*	N	R	N	R	N	R	N	R	N	R	N	R	N	
1975	444	11.9	288	7.7	175	2.8	1	0.2	111	5.0	98	4.4	62	2.8	0	
1976	434	13.0	233	7.0	131	4.0	0	0	167	9.2	94	5.2	56	3.1	0	
1977	860	15.1	472	7.4	284	4.5	0	0	365	10.8	223	6.6	139	4.1	0	
3 Yrs.	1738	13.0	993	7.4	590	4.4	1	0.0	643	8.7	415	5.6	257	3.5	0	

*R = Cases per 100 athletes

TABLE 15
FREQUENCY OF ANKLE SPRAINS
BY SEVERITY FOR COLLEGE FOOTBALL
1975-1977 (NAIRS I & II)

	Total Season							Game-Related						
	Reportable		Significant		Major		Severe	Reportable		Significant		Major		Severe
	N	R*	N	R	N	R	N	N	R	N	R	N	R	N
1975	462	12.4	142	3.8	36	1.0	0	187	8.4	62	2.7	16	0.7	0
1976	412	12.4	109	3.3	26	0.8	0	184	10.1	65	3.6	20	1.1	0
1977	761	12.0	199	3.1	39	0.6	0	295	8.7	80	2.4	14	0.4	0
3 Yrs.	1635	12.1	450	3.4	101	0.8	0	666	9.0	207	2.8	50	0.7	0

*R = Cases per 100 athletes

TABLE 16
TOTAL SURFACE EXPOSURE
COLLEGE FOOTBALL
1975-1977 (NAIRS I ONLY)

	1975	1976	1977	3-Year Total
Natural Surface				
Practice	157250	146427	297520	601197
Game	14136	11238	20520	45894
Total Season	171386	157665	318040	647091
Astroturf				
Practice	89881	81505	143407	314793
Game	5922	5877	11620	23419
Total Season	95803	87382	155027	338212
Tartanturf				
Practice	32637	26285	39913	98835
Game	2663	2367	3248	8278
Total Season	35300	28652	43161	107113
Polyturf				
Practice	0	0	4256	4256
Game	657	0	498	1155
Total Season	657	0	4754	5411
Total Exposure				
Practice	279768	254217	485096	1019081
Game	23378	19482	35886	78746
Total Season	303146	273699	520982	1097827

TABLE 17
PROPORTION OF EXPOSURE BY OCCASION AND SURFACE
COLLEGE FOOTBALL
1975-1977 (NAIRS I ONLY)

	Game Related				Sport Related			
	1975	1976	1977	3-Yr.	1975	1976	1977	3-Yr.
NATURAL SURFACE								
Percent Exposure	62%	58%	58%	59%	57%	58%	61%	59%
ASTROTURF								
Percent Exposure	26%	30%	33%	30%	32%	32%	30%	31%
TARTANTURF								
Percent Exposure	12%	12%	09%	11%	12%	10%	8%	10%

TABLE 18
SELECTED SIGNIFICANT INJURY RATES, TOTAL SEASON
BY SURFACE PER 1000 ATHLETE-EXPOSURES(AE)
COLLEGE FOOTBALL
1975-1977 (NAIRS I ONLY)

	Natural			Astroturf			Tartanturf		
	1975	1976	1977	1975	1976	1977	1975	1976	1977
Concussions									
Case/1000AE	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.1
N	15	11	21	4	6	12	1	4	3
Meniscus/Knee Sprains									
Case/1000AE	0.8	0.8	0.7	1.0	0.8	1.1	1.2	1.1	1.1
N	143	128	246	99	74	175	43	31	47
Ankle Sprains									
Case/1000AE	0.4	0.3	0.3	0.5	0.4	0.5	0.6	0.9	0.7
N	71	48	89	49	36	70	20	25	30
Foot Sprains									
Case/1000AE	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.2	0.1
N	4	5	3	6	6	9	2	5	5
Great Toe Sprains									
Case/1000AE	0	0.0	0	0.0	0.0	0.0	0	0	0.0
N	0	1	0	3	2	3	0	0	2
Lower Leg/Ankle Fx									
Case/1000AE	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.1
N	11	11	23	6	6	8	1	1	5
Abrasions									
Case/1000AE	0	0	0	0.0	0	0	0	0.0	0
N	0	0	0	1	0	0	0	1	0

TABLE 19
SELECTED SIGNIFICANT INJURY RATES, GAME-RELATED
BY SURFACE PER 1000 ATHLETE-EXPOSURES(AE)
COLLEGE FOOTBALL
1975-1977 (NAIRS I ONLY)

	Natural			Astroturf			Tartanturf		
	1975	1976	1977	1975	1976	1977	1975	1976	1977
Concussions									
Case/1000AE	0.4	0.4	0.4	0.3	0.3	0.5	0	0.4	0
N	5	5	8	2	2	6	0	1	0
Meniscus/Knee Sprains									
Case/1000AE	4.1	4.3	5.4	4.2	5.3	7.0	7.9	5.9	8.6
N	58	49	111	25	31	82	21	14	28
Ankle Sprains									
Case/1000AE	2.4	2.2	1.7	3.0	3.9	2.6	3.0	7.2	4.0
N	34	25	36	18	23	30	8	17	13
Foot Sprains									
Case/1000AE	0.1	0.2	0.0	0.2	0.2	0.5	0.4	1.3	0.6
N	1	2	1	1	1	6	1	3	2
Great Toe Sprains									
Case/1000AE	0	0	0	0.2	0	0.1	0	0	0.3
N	0	0	0	1	0	1	0	0	1
Lower Leg/Ankle Fx									
Case/1000AE	0.1	0.6	0.6	0.3	0.7	0.2	0	0	0.3
N	1	7	12	2	4	3	0	0	1
Abrasions									
Case/1000AE	0	0		0	0	0	0	0.4	0
N	0	0	0	0	0	0	0	1	0

TABLE 20
SELECTED REPORTABLE INJURY RATES, GAME-RELATED
BY SURFACE PER 1000 ATHLETE-EXPOSURES(AE)
COLLEGE FOOTBALL
1975-1977 (NAIRS I ONLY)

	Natural			Astroturf			Tartanturf		
	1975	1976	1977	1975	1976	1977	1975	1976	1977
Concussions									
Case/1000AE	3.3	4.6	4.8	4.0	4.4	5.8	8.6	8.9	5.2
N	46	52	99	24	26	68	23	21	17
Meniscus/Knee Sprains									
Case/1000AE	8.1	7.6	8.8	8.8	10.6	12.0	13.9	9.3	12.6
N	115	86	180	52	62	140	37	22	41
Ankle Sprains									
Case/1000AE	6.5	7.2	7.4	10.6	11.9	9.1	9.8	13.9	10.5
N	92	81	151	63	70	106	26	33	34
Foot Sprains									
Case/1000AE	0.6	0.6	0.6	2.7	2.7	2.1	1.5	5.5	2.5
N	8	7	12	16	16	25	4	13	8
Great Toe Sprains									
Case/1000AE	0.2	0.2	0.2	2.0	1.5	1.0	0.4	0.4	0.6
N	3	2	5	12	9	12	1	1	2
Lower Leg/Ankle Fx									
Case/1000AE	0.1	0.6	0.6	0.3	0.7	0.2	0	0	0.3
N	1	7	12	2	4	3	0	0	1
Abrasions									
Case/1000AE	0.2	0.1	0.1	1.3	0	0.2	0.4	0.4	0
N	3	1	1	8	0	2	1	1	0

TABLE 21
THE NUMBER OF ADDITIONAL SIGNIFICANT INJURIES
A COLLEGE FOOTBALL TEAM CAN EXPECT IF ALL EXPOSURES
IN ONE SEASON ARE ON ASTROTURF OR TARTANTURF
RATHER THAN NATURAL SURFACE
(FROM TABLE 18)

	Astroturf			Tartanturf		
	1975	1976	1977	1975	1976	1977
Concussion	ND	ND	ND	ND	ND	ND
Meniscus/Knee Sprain	1	ND	2**	2**	2	2**
Ankle Sprain	ND	ND	1**	1	3***	2***
Foot Sprain	ND	ND	ND	ND	1	ND
Great Toe Sprain	ND	ND	ND	ND	ND	ND
Lower Leg Fracture	ND	ND	ND	ND	ND	ND
Abrasion	ND	ND	ND	ND	ND	ND

ND = No Difference by critical interval test
Absence of astrisk = No difference by Chi Square
@ = Yates correction of continuity applied
* = Probability equal to or less than .05 level
** = Probability equal to or less than .01 level
*** = Probability equal to or less than .001 level

TABLE 22
THE NUMBER OF ADDITIONAL SIGNIFICANT INJURIES
A COLLEGE FOOTBALL TEAM CAN EXPECT IF ALL GAMES
IN ONE SEASON ARE ON ASTROTURF OR TARTANTURF
RATHER THAN NATURAL SURFACE
(FROM TABLE 19)

	Astroturf			Tartanturf		
	1975	1976	1977	1975	1976	1977
Concussion	ND	ND	ND	-2	ND	-2
Meniscus/Knee Sprain	ND	ND	ND	2*	ND	1*
Ankle Sprain	ND	ND	ND*	ND	2***	1***
Foot Sprain	ND	ND	ND	ND	ND	ND
Great Toe Sprain	ND	ND	ND	ND	ND	ND
Lower Leg Fracture	ND	ND	ND	ND	ND	ND
Abrasion	ND	ND	ND	ND	ND	ND

ND = No Difference by critical interval test
Absence of astrisk = No difference by Chi Square
@ = Yates correction for continuity applied
* = Probability equal to or less than .05 level
** = Probability equal to or less than .01 level
*** = Probability equal to or less than .001 level

TABLE 23
THE NUMBER OF ADDITIONAL REPORTABLE INJURIES
A COLLEGE FOOTBALL TEAM CAN EXPECT IF ALL GAMES
IN ONE SEASON ARE ON ASTROTURF OR TARTANTURF
RATHER THAN NATURAL SURFACE
(FROM TABLE 20)

	Astroturf			Tartanturf		
	1975	1976	1977	1975	1976	1977
Concussion	ND	ND	ND	2	2	ND
Meniscus/Knee Sprain	ND	1*	1**	3**	ND	2**
Ankle Sprain	2**	2**	ND	1	3***	1
Foot Sprain	1	1	ND	ND	2	1
Great Toe Sprain	1	ND	ND	ND	ND	ND
Lower Leg Fracture	ND	ND	ND	ND	ND	ND
Abrasion	ND	ND	ND	ND	ND	ND

ND = No Difference by critical interval test
Absence of astrisk = No difference by Chi Square
@ = Yates correction for continuity applied
* = Probability equal to or less than .05 level
** = Probability equal to or less than .01 level
*** = Probability equal to or less than .001 level

TABLE 24
SIGNIFICANT ANKLE SPRAINS, TOTAL SEASON
PER 1000 ATHLETE-EXPOSURES(AE)
BY SHOE TYPE AND SURFACE
COLLEGE FOOTBALL
1975-1977 (NAIRS I ONLY)

	Natural			Astroturf			Tartanturf		
	1975	1976	1977	1975	1976	1977	1975	1976	1977
Standard Cleat									
Cases/1000AE	0.4	0.2	0.2	0	0	0	0	0	*
N	33	17	24	0	0	0	0	0	1
Soccer Cleat									
Cases/1000AE	0.5	0.3	0.4	0.5	0.6	0.4	0.5	2.1	0.9
N	22	13	24	8	5	3	5	7	2
Multicleat									
Cases/1000AE	0.3	0.5	0.3	0.5	0.4	0.5	0.8	1.1	0.7
N	13	21	45	29	29	72	11	19	27
Ripple Sole									
Cases/1000AE	*	0	0	1.1	0	*	0.3	0	0
N	1	0	0	8	0	0	1	0	0
No Cleat									
Cases/1000AE	*	*	0	0.3	0	*	0	0	0
N	4	2	0	1	0	0	0	0	0
Other									
Cases/1000AE	0	*	0.8	0.7	0.4	0.3	*	0	0
N	0	2	7	7	2	1	2	0	0

*Less than one percent exposure

TABLE 25
SIGNIFICANT ANKLE SPRAINS, GAME-RELATED
PER 1000 ATHLETE-EXPOSURES(AE)
BY SHOE TYPE AND SURFACE
COLLEGE FOOTBALL
1975-1977 (NAIRS I ONLY)

	Natural			Astroturf			Tartanturf		
	1975	1976	1977	1975	1976	1977	1975	1976	1977
Standard Cleat									
Cases/1000AE	2.2	1.8	1.4	0	0	*	0	0	0
N	17	10	9	0	0	0	0	0	0
Soccer Cleat									
Cases/1000AE	2.5	2.1	2.1	3.6	7.3	1.2	1.8	8.9	0
N	9	6	9	4	4	1	1	3	0
Multicleat									
Cases/1000AE	1.6	3.0	2.3	2.8	3.8	3.3	3.7	8.9	4.4
N	4	9	21	9	18	33	5	14	13
Ripple Sole									
Cases/1000AE	*	0	0	3.2	0	0	4.1	0	0
N	1	0	0	1	0	0	1	0	0
No Cleat									
Cases/1000AE	*	*	0	0	*	*	0	0	0
N	4	2	0	0	0	0	0	0	0
Other									
Cases/1000AE	0	*	5.3	11.2	5.2	4.7	0	0	0
N	0	1	4	5	1	1	0	0	0

*Less than one percent exposure

TABLE 26
REPORTABLE ANKLE SPRAINS, GAME-RELATED
PER 1000 ATHLETE-EXPOSURES(AE)
BY SHOE TYPE AND SURFACE
COLLEGE FOOTBALL
1975-1977 (NAIRS I ONLY)

	Natural			Astroturf			Tartanturf		
	1975	1976	1977	1975	1976	1977	1975	1976	1977
Standard Cleat									
Cases/1000AE	5.3	6.7	7.2	0	0	21.1	0	0	*
N	41	37	47	0	0	5	0	0	3
Soccer Cleat									
Cases/1000AE	7.0	4.5	9.6	9.1	16.5	4.8	3.5	17.8	4.8
N	25	13	41	10	9	4	2	6	1
Multicleat									
Cases/1000AE	7.8	10.1	7.3	9.3	12.2	9.6	11.7	15.3	10.1
N	20	30	68	30	58	95	16	24	30
Ripple Sole									
Cases/1000AE	*	0	0	51.7	0	75.2	8.2	0	87.7
N	2	0	0	16	0	3	2	0	1
No Cleat									
Cases/1000AE	*	*	*	8.5	28.8	27.7	11.6	28.4	0
N		3	1	4	3	5	6	3	0
Other									
Cases/1000AE	0	*	14.7	11.2	15.7	9.5	*	*	0
N	0	1	11	5	3	2	1	5	0

*Less than one percent exposure

TABLE 27
SIGNIFICANT MENISCUS/KNEE SPRAINS, TOTAL SEASON
PER 1000 ATHLETE-EXPOSURES (AE)
BY SHOE TYPE AND SURFACE
COLLEGE FOOTBALL
1975-1977 (NAIRS I ONLY)

	Natural			Astroturf			Tartanturf		
	1975	1976	1977	1975	1976	1977	1975	1976	1977
Standard Cleat									
Cases/1000AE	0.9	0.7	0.6	0	0	17.8	*	0	0
N	70	47	68	0	0	6	1	0	0
Soccer Cleat									
Cases/1000AE	1.0	0.7	0.9	1.4	1.2	1.1	1.6	3.0	2.3
N	41	31	53	23	10	9	15	10	5
Multicleat									
Cases/1000AE	0.6	1.0	0.9	1.2	0.7	1.1	1.3	1.1	1.1
N	30	44	121	63	54	154	18	20	44
Ripple Sole									
Cases/1000AE	0	0	0	0.7	*	1.2	0.7	0	0
N	0	0	0	5	1	2	2	0	0
No Cleat									
Cases/1000AE	*	*	0	1.6	0	1.5	0.7	0	0
N	3	3	1	5	0	3	6	0	0
Other									
Cases/1000AE	*	*	1.2	0.3	1.1	0.3	*	0	0
N	2	3	10	3	5	1	1	0	0

*Less than one percent exposure

TABLE 28
SIGNIFICANT MENISCUS/KNEE SPRAINS, GAME-RELATED
PER 1000 ATHLETE-EXPOSURES(AE)
BY SHOE TYPE AND SURFACE
COLLEGE FOOTBALL
1975-1977 (NAIRS I ONLY)

	Natural			Astroturf			Tartanturf		
	1975	1976	1977	1975	1976	1977	1975	1976	1977
Standard Cleat									
Cases/1000AE	4.2	4.7	4.7	0	0	12.7	*	0	0
N	33	26	31	0	0	3	1	0	0
Soccer Cleat									
Cases/1000AE	4.8	3.5	6.8	3.6	11.0	7.3	10.6	11.9	9.6
N	17	10	29	4	6	6	6	4	2
Multicleat									
Cases/1000AE	4.1	3.7	5.4	4.3	4.6	7.1	8.0	6.4	8.4
N	8	11	50	14	22	70	11	10	25
Ripple Sole									
Cases/1000AE	0	0	0	6.5	0	0	8.2	0	0
N	0	0	0	2	0	0	2	0	0
No Cleat									
Cases/1000AE	0	0	0	4.2	*	11.1	1.9	0	0
N	0	1	1	2	0	2	1	0	0
Other									
Cases/1000AE	*	*	6.7	4.5	5.2	*	0	0	0
N	1	1	5	2	1	0	0	0	0

*Less than one percent exposure

TABLE 29
REPORTABLE MENISCUS/KNEE SPRAINS, GAME-RELATED
PER 1000 ATHLETE-EXPOSURES(AE)
BY SHOE TYPE AND SURFACE
COLLEGE FOOTBALL
1975-1977 (NAIRS I ONLY)

	Natural			Astroturf			Tartanturf		
	1975	1976	1977	1975	1976	1977	1975	1976	1977
Standard Cleat									
Cases/1000AE	7.6	7.5	9.9	0	0	21.1	*	0	0
N	59	41	65	0	0	5	1	0	0
Soccer Cleat									
Cases/1000AE	9.3	5.9	10.3	10.9	18.4	8.5	14.1	17.8	9.6
N	33	17	44	12	10	7	8	6	2
Multicleat									
Cases/1000AE	8.9	7.8	7.9	7.1	9.6	12.6	12.4	10.2	11.8
N	23	23	73	23	46	124	17	16	35
Ripple Sole									
Cases/1000AE	0	0	0	25.8	0	0	20.6	0	0
N	0	0	0	8	0	0	5	0	0
No Cleat									
Cases/1000AE	0	*	*	12.7	9.6	16.6	5	*	*
N	0	1	1	6	1	3	9.6	0	1
Other									
Cases/1000AE	0	*	9.3	6.7	21.0	4.7	0	61.7	0
N	0	3	7	3	4	1	0	1	0

*Less than one percent exposure

TABLE 30
SIGNIFICANT MENISCUS/KNEE SPRAINS, TOTAL SEASON,
PER 1000 ATHLETE-EXPOSURES
BY SHOE TYPE AND MANUFACTURER FOR ARTIFICIAL SURFACE
COLLEGE FOOTBALL
1975-1977 (NAIRS I ONLY)

	All Shoes	Shoe #1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13
Rate														
1975	1.2	1.0	1.2	0	0.9	1.3	4.9	1.6	1.3	2.8	0.6	0.2	1.5	0
1976	0.9	2.7	1.0	0.8	3.1	0.7	1.1	0	0	0	0	1.1	0	0.2
1977	1.2	1.0	1.2	0.9	69.4	1.6	0.9	0.9	0	0.9	0.0	0	0.0	1.5
Cases														
1975	147	5	43	0	11	19	8	9	8	10	6	2	10	0
1976	102	6	57	2	8	9	6	0	0	0	0	5	0	2
1977	226	6	133	7	3	18	2	10	0	25	1	0	0	3
% Use														
1975	100	4.0	28.9	2.1	10.2	11.5	1.3	4.4	5.0	2.8	8.2	7.5	5.2	0
1976	100	2.0	53.6	2.2	2.4	12.5	5.1	0.3	0.8	5.2	0	4.2	0	7.5
1977	100	3.1	56.3	3.8	0.0	5.6	1.1	5.8	0	13.9	0	0	0.3	1.0

TABLE 32
DIFFERENCE IN FREQUENCY OF MENISCUS/KNEE SPRAINS AND ANKLE SPRAINS ON NATURAL TURF FOR SOCCER TYPE AND MULTICLEATS COMPARED TO STANDARD CLEATS FOR COLLEGE FOOTBALL 1975-1977 (FROM TABLES 29-31)

	Soccer			Multicleat		
	1975	1976	1977	1975	1976	1977
Meniscus/Knee Sprain						
Significant Season Related	1	ND	2**	-2*	2	2**
Significant Game Related	ND	ND	1	ND	ND	ND
All Reported Game Related	1	ND	ND	ND	ND	1
Ankle Sprain						
Significant Season Related	ND	ND	1**	ND	2*	ND
Significant Game Related	ND	ND	ND	ND	ND	ND
All Reported Game Related	ND	-1	1	1	1	ND

ND = No difference by critical interval test
Absence of astrisk = No difference by Chi Square
@ = Yates correction for continuity applied
* = Probability equal to or less than .05 level
** = Probability equal to or less than .01 level
*** = Probability equal to or less than .001 level

TABLE 33
FREQUENCY OF MENISCUS/KNEE SPRAINS AND ANKLE SPRAINS
PER 1000 ATHLETE-EXPOSURES (AE) BY AGE OF SURFACE
AND SEVERITY CATEGORY FOR COLLEGE FOOTBALL 1975-1977 (NAIRS I ONLY)

	Old Astroturf			New Astroturf			Old Tartanturf			New Tartanturf		
	1975	1976	1977	1975	1976	1977	1975	1976	1977	1975	1976	1977
Meniscus/Knee												
All Reported												
Rate/1000AE	7.2	10.3	12.0	12.1	10.1	11.9	18.0	10.0	10.4	8.2	6.5	16.3
N	29	35	72	23	25	67	26	19	26	10	3	12
Significant												
Rate/1000AE	4.0	4.7	6.7	4.7	6.0	7.3	9.7	6.8	7.6	5.7	2.1	10.8
N	16	16	40	9	15	41	14	13	19	7	1	8
Ankle												
All Reported												
Rate/1000AE	8.4	12.9	11.5	15.3	10.5	6.5	11.8	15.8	9.2	7.4	6.4	14.9
N	34	44	69	29	26	37	17	30	23	9	3	11
Significant												
Rate/1000AE	2.5	4.1	3.3	9.2	3.6	1.8	2.8	8.9	4.4	3.3	0	2.7
N	10	14	20	8	9	10	4	17	11	4	0	2

TABLE 34
DIFFERENCE IN FREQUENCY OF MENISCUS/KNEE SPRAINS AND
ANKLE SPRAINS FOR NEW ARTIFICIAL SURFACE
COMPARED TO OLD ARTIFICIAL SURFACE
FOR COLLEGE FOOTBALL 1975-1977 (FROM TABLE 33)

	Astroturf			Tartanturf		
	1975	1976	1977	1975	1976	1977
Meniscus/Knee Sprain						
All Reported Game Related	2	ND	ND	-3*	-2@	3
Significant Game Related	ND	ND	ND	ND@	-3*@	ND@
Ankle Sprain						
All Reported Game Related	ND**	ND	ND	ND**	ND	ND
Significant Game Related	ND	ND	ND	-2	-2@	1

ND = No difference by critical interval test
Absence of astrisk = No difference by Chi Square
@ = Yates correction for continuity applied
* = Probability equal to or less than .05 level
** = Probability equal to or less than .01 level
*** = Probability equal to or less than .001 level

TABLE 35
FREQUENCY OF MENISCUS/KNEE SPRAINS AND ANKLE SPRAINS PER 1000 ATHLETE-EXPOSURES (AE) TO NATURAL TURF FOR BOTH HOME AND AWAY GAMES FOR COLLEGE FOOTBALL 1975-1977 (NAIRS I ONLY)

	HOME			AWAY		
	1975	1976	1977	1975	1976	1977
Meniscus/Knee						
All Reported						
Rate/1000 AE	7.8	6.3	9.0	8.4	8.5	8.4
N	63	34	96	51	50	83
Significant						
Rate/1000 AE	3.8	3.0	5.6	4.3	5.4	5.0
N	31	16	60	26	32	50
Ankle						
All Reported						
Rate/1000 AE	5.3	7.6	7.6	8.0	6.8	7.0
N	43	41	58	49	40	70
Significant						
Rate/1000 AE	2.2	3.0	2.3	2.6	1.5	1.2
N	18	16	24	16	9	12

TABLE 36
DIFFERENCE IN MENISCUS/KNEE SPRAINS AND ANKLE SPRAINS
WHEN AWAY GAME EXPERIENCES ARE COMPARED TO HOME GAME EXPERIENCES
ON NATURAL TURF FOR COLLEGE FOOTBALL 1975-1977 (FROM TABLE 35)

	1975	1976	1977
Meniscus/Knee Sprain			
All Reported	ND	1	ND
Significant	ND	ND*	ND
Ankle Sprain			
All Reported	1	ND	ND
Significant	ND	ND	ND

ND = No difference by critical interval test
Absence of astrisk = No difference by Chi Square
@ = Yates correction for continuity applied
* = Probability equal to or less than .05 level
** = Probability equal to or less than .01 level
*** = Probability equal to or less than .001 level

TABLE 37
FREQUENCY OF MENISCUS/KNEE SPRAINS AND ANKLE SPRAINS
PER 1000 ATHLETE-EXPOSURES (AE) TO ASTRCTURF FOR
BOTH HOME AND AWAY GAMES FOR COLLEGE FOOTBALL
1975-1977 (NAIRS I ONLY)

	HOME			AWAY		
	1975	1976	1977	1975	1976	1977
Meniscus/Knee						
All Reported						
Rate/1000 AE	8.2	10.1	10.3	9.5	11.2	13.8
N	28	36	63	24	26	76
Significant						
Rate/1000 AE	4.1	4.8	5.2	4.4	6.0	8.9
N	14	17	32	11	14	49
Ankle						
All Reported						
Rate/1000 AE	8.5	9.3	6.7	13.5	15.9	11.8
N	29	33	41	34	27	65
Significant						
Rate/1000 AE	3.8	4.2	1.6	2.0	3.4	3.6
N	13	15	10	5	8	20

TABLE 38
DIFFERENCE IN MENISCUS/KNEE SPRAINS AND ANKLE SPRAINS
WHEN AWAY GAME EXPERIENCES ARE COMPARED TO HOME GAME EXPERIENCES
ON ASTROTURF FOR COLLEGE FOOTBALL 1975-1977 (FROM TABLE 37)

	1975	1976	1977
Meniscus/Knee Sprain			
All Reported	ND	ND	1
Significant	ND	ND	2*
Ankle Sprain			
All Reported	2	3	2**
Significant	-1	ND	ND*

ND = No difference by critical interval test
Absence of astrisk = No difference by Chi Square
@ = Yates correction for continuity applied
* = Probability equal to or less than .05 level
** = Probability equal to or less than .01 level
*** = Probability equal to or less than .001 level

TABLE 39
FREQUENCY OF MENISCUS/KNEE SPRAINS AND ANKLE SPRAINS PER 1000 ATHLETE-EXPOSURES (AE) TO TARTANTURF FOR BOTH HOME AND AWAY GAMES FOR COLLEGE FOOTBALL 1975-1977 (NAIRS I ONLY)

	HOME			AWAY		
	1975	1976	1977	1975	1976	1977
Meniscus/Knee						
All Reported						
Rate/1000 AE	8.8	10.1	13.6	20.4	8.3	8.0
N	14	13	29	22	9	9
Significant						
Rate/1000 AE	5.7	6.2	9.9	11.2	5.5	5.4
N	9	8	21	12	6	6
Ankle						
All Reported						
Rate/1000 AE	8.2	11.7	8.5	12.1	16.6	14.3
N	13	15	18	13	18	16
Significant						
Rate/1000 AE	2.5	5.4	3.3	3.7	9.2	5.4
N	4	7	7	4	10	6

TABLE 40
DIFFERENCE IN MENISCUS/KNEE SPRAINS AND ANKLE SPRAINS
WHEN AWAY GAME EXPERIENCES ARE COMPARED TO HOME GAME EXPERIENCES
ON TARTANTURF FOR COLLEGE FOOTBALL 1975-1977 (FROM TABLE 39)

	1975	1976	1977
Meniscus/Knee Sprain			
All Reported	3**	-1	-3
Significant	2	ND	-2
Ankle Sprain			
All Reported	2	2	3
Significant	ND@	2	1@

ND = No difference by critical interval test
Absence of astrisk = No difference by Chi Square
@ = Yates correction for continuity applied
* = Probability equal to or less than .05 level
** = Probability equal to or less than .01 level
*** = Probability equal to or less than .001 level

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APPENDIX A

NAIRS 77–78
INSTITUTION ABSTRACT

ID ☐☐☐☐☐☐☐☐

CHECK OR PRINT CODES THAT APPLY

1. INSTITUTION: _____

Street Address: _____

City: _____

State: _____ Zip: _____

Staff Contact Person: _____

Title: _____

Telephone: (____) _____

2. PRINCIPAL MEDICAL COVERAGE OF ATHLETIC PROGRAM

[1] Team Physician(s), Institution Staff
[2] Team Physician(s), Community based
[3] Clinic/Hospital
[4] Community Physicians as needed
[5] Intern/Resident
[9] Other _____

Also Code:
[1] M.D. [2] D.O. Other _____

3. PRINCIPAL NON-PHYSICAIN PROVIDING ON-SITE FIRST AID CARE FOR ATHLETIC TEAMS

[71] Athletic Trainer, NATA Certified Member, N = ☐
[72] Athletic Trainer, NATA Associate Member, N = ☐
[73] Athletic Trainer, Other, N = ☐
[74] Coaching Staff
[75] Student, N = ☐
[76] School Nurse
[77] Emergency Care Personnel
[78] Physical Therapist
[79] Parent

4. MEDICAL RESOURCES (all that apply)

[1] Separate training room for taping and therapy
[1] Separate medical room for on-site examination and treatment
[1] Emergency vehicle, equipped, immediately available

Emergency Hospitalization
[a] Within 10 minutes of practice site
[b] 10-30 minutes of practice site
[c] More than 30 minutes from practice site

5. PRESEASON MEDICAL EXAM

[1] Required only for athlete's first sport of year
[2] Required for each sport
[3] Required for some sports but not others
[4] Not Required
[5] Other _____

6. SIZE OF COMMUNITY

[1] less than 15,000
[2] 15,000 to 50,000
[3] 50,000 to 100,000
[4] 100,000 +

7. ENROLLMENT (H.S.: Grades 10-12, College: U-G's only)

1 – less than 150
2 – 151 to 500
3 – 501 to 1,000
4 – 1,001 to 2,000
5 – 2,001 to 5,000
6 – 5,001 to 10,000
7 – 10,001 +

Code
MALE ☐
FEMALE ☐

8. VARSITY SPORTS (numbers of varsity sports offered this school year)

Male ☐☐ Female ☐☐ Mixed* ☐☐ *See Guidebook

9. REMARKS:

10. RESEARCH (1) ☐☐ (2) ☐☐ (3) ☐☐ (4) ☐☐

Form 78.1 National Athletic Injury/Illness Reporting System, The Pennsylvania State University, 131 White Building, University Park, Pa. 16802, 814-865-9593

APPENDIX B

PRINT FOUR AS 4

NAIRS – 1

77–78

PARTICIPANT

ABSTRACT

1. INSTITUTION ☐☐☐☐☐☐☐☐ 2. SPORT ☐☐

(Return immediately after first scheduled competition)

3 Participant	4 Age	5 Ht	6 Wt	7 Educ	8 Exp	9 Perf	3 Participant	4 Age	5 Ht	6 Wt	7 Educ	8 Exp	9 Perf
☐☐☐☐	☐☐	☐	☐	☐☐	☐	☐	☐☐☐☐	☐☐	☐	☐	☐☐	☐	☐
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Form 78-3 National Athletic Injury/Illness Reporting System, The Pennsylvania State University, 131 White Building, University Park, Pa. 16802, 814-865-9593

CODE FOR PARTICIPANT ABSTRACT

1. Sport Code

See Inside Front Cover, NAIRS-I Recorder's Handbook

3. Participant (Use NAIRS Log)

4. Age (Use nearest age at season's onset)

5. Height

1 — less than 5'0"

2 — 5'0"—5'3"

3 — 5'4"—5'7"

4 — 5'8"—5'11"

5 — 6'0"—6'3"

6 — 6'4"—6'7"

7 — 6'8" +

6. Weight at beginning of season.
(Wrestlers use initial official weigh in)

1 — less than 112

2 — 112—124

3 — 125—139

4 — 140—154

5 — 155—169

6 — 170—189

7 — 190—209

8 — 210—234

9 — 235 +

7. Education (Year in School)
(09 — 9th grade; 13 — 1st year in college)

09 10 11 12 13 14 15 16 17

(00 = not in school)

8. Experience in Sport*

1 — First year

2 — 2—3 years

3 — 4—5 years

4 — 6—10 years

5 — 11+ years

*Years under formal coaching, this sport, including this season

9. Performance Rating

1 — Starter (expected to start every game)

2 — Regular (expected to play in every game even if not a starter)

3 — Substitute (not expected to play in every game)

APPENDIX C

CHECK OR PRINT CODES THAT APPLY

1. INSTITUTION

2. PARTICIPANT — Sport / Athlete / Episode

NAIRS–I
77–78
CASE ABSTRACT

3. ONSET / RETURN — Date / Month

4. TIME
[1] AM (Before Noon)
[2] Aft (Noon-6pm)
[3] Eve (After 6pm)

5. SEASON
[1] Pre-Opener Period
[2] Regular Season
[3] Post-Season Play

6. DIAGNOSIS
Principal
Other

EXTREMITY
[0] Not Applicable
[1] Right
[2] Left
[3] Both

PRIMARY MECHANISM
[0] Unknown
[1] Direct Impact
[2] Indirect Force
[3] Torsion
[4] Stretch
[5] Impingement
[6] Overuse
[7] Shearing
[8] Other, Spontaneous
[9] Other, Insidious

REMARKS: (continue on backside)

7. OCCASION
10 Not Sport-Related
[11] Residence
[12] Vehicle, Passenger
[13] Vehicle, Pedestrian
[14] School, not sport/phys ed
[15] Job
[16] Public, Other

2* Varsity Sports
[20] Competition, Home
[21] Competition, Away
[22] Team Travel, Vehicle
[23] Team Travel, Other
[24] Locker/Shower/Training Room
[25] Between Lockerroom/Arena
[26] Practice/Skill Training
[27] Practice/Conditioning
[28] Practice/Scrimmage
[29] Practice/Contest

3 __* Sub-Varsity Sports
4 __* Club Sports
5 __* Intramural Sports
6 __* Physical Education
7 __* Community Recreation
8 __* Other Varsity Sport
9 __* Other _____

*for second digit, refer to Varsity Sport subheadings

WHEN STRICKEN:
9. POSITION
10. ACTIVITY
11. SITUATION
12. SURFACE

13. SURFACE CONDITION
[1] Normal
[2] Icy
[3] Snow-covered
[4] Wet
[5] Slippery, not wet
[6] Muddy
[7] Hard
[8] Irregular

14. PROTECTION OF INJURED BODY PART
[1] None
[2] Taped
[3] Wrapped
[4] Specially padded
[5] Customary uniform
[6] Bandaged
[7] Brace
[8] Cast
[9] Special Device

15. EQUIPMENT INVOLVED (Use 0's if relevant but unknown)
Type / Brand / Vintage*

*Code for Vintage
1 New this season
2 New previous season
3 Used previous season
4 Reconditioned for this season
5 Reconditioned previous season(s)

16. NATURE OF INJURY/ILLNESS
[1] New Problem, this season and last
[2] Recurrence, this sport, this season
[3] Recurrence, this sport, last season
[4] Recurrence, other sport, since last season
[5] Complication, episode [ ] this sport, this season
[6] Complication, other sport, since last season

17. ACTION TAKEN
[1] Not hospitalized, not confined to bed
[2] Hospitalized less than 18 hours
[3] Hospitalized at least 18 hours
[4] Confined, other, at least 18 hours

18. PRINCIPAL MANAGEMENT OF INJURY/ILLNESS
[1] Surgery
[2] Superficial debridement, minor suturing, dental work, etc
[3] Nonsurgical immobilization
[4] Therapeutic modalities
[5] Prescription drug therapy
[6] Proprietary management (asprin, butterfly bandage)
[7] Rest
[8] Post-season surgery scheduled (returned to play)

19. RESEARCH (1) (2) (3) (4) (5) (6) (7)

8. SOURCE OF DIAGNOSIS

Physician† OR Non-Physician

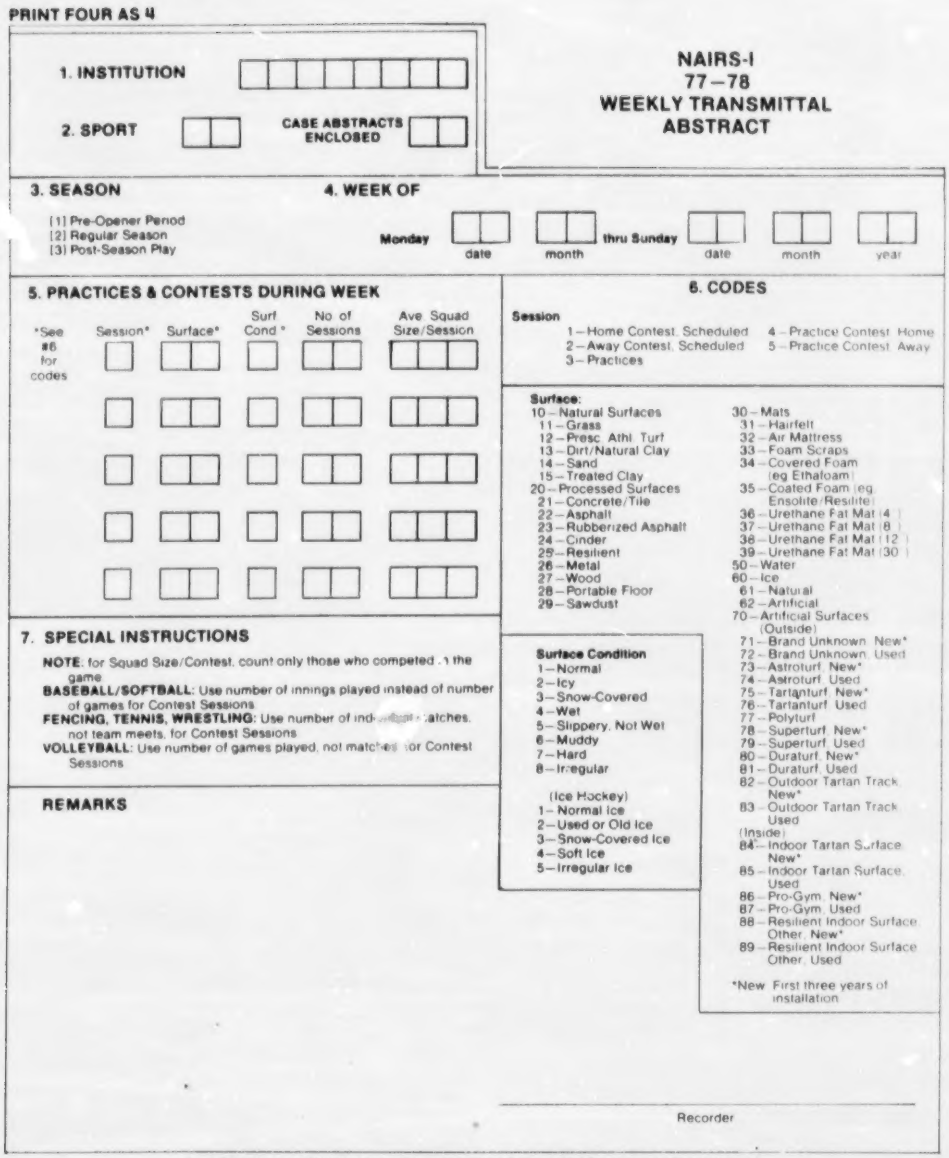
[1] Team Physician, Institution Staff
[2] Team Physician, Community based
[3] Clinic/Hospital Staff
[4] Community Practitioner
[5] Intern/Resident
[9] Other _____

[71] Athletic Trainer, NATA Certified Member
[72] Athletic Trainer, NATA Associate Member
[73] Athletic Trainer, Other
[74] Coaching Staff
[75] Student Trainer
[76] School Nurse
[77] Emergency Care Personnel
[78] Physical Therapist
[79] Parent

†Also Code:
[1] M D [2] D O [3] D C [4] D D S [5] D P M [6] O D

Form 78-4 National Athletic Injury/Illness Reporting System, The Pennsylvania State University, 131 White Building, University Park, Pa. 16802, 814-865-9593

APPENDIX D



PRINT FOUR AS 4

1. INSTITUTION

2. SPORT

CASE ABSTRACTS ENCLOSED

NAIRS-I
77–78
WEEKLY TRANSMITTAL ABSTRACT

3. SEASON

[1] Pre-Opener Period
[2] Regular Season
[3] Post-Season Play

4. WEEK OF

Monday (date / month) thru Sunday (date / month / year)

5. PRACTICES & CONTESTS DURING WEEK

*See #6 for codes	Session*	Surface*	Surf Cond.*	No. of Sessions	Ave. Squad Size/Session

6. CODES

Session
1–Home Contest, Scheduled
2–Away Contest, Scheduled
3–Practices
4–Practice Contest, Home
5–Practice Contest, Away

Surface:
10–Natural Surfaces
11–Grass
12–Presc. Athl. Turf
13–Dirt/Natural Clay
14–Sand
15–Treated Clay
20–Processed Surfaces
21–Concrete/Tile
22–Asphalt
23–Rubberized Asphalt
24–Cinder
25–Resilient
26–Metal
27–Wood
28–Portable Floor
29–Sawdust
30–Mats
31–Hairfelt
32–Air Mattress
33–Foam Scraps
34–Covered Foam (eg Ethafoam)
35–Coated Foam (eg Ensolite/Resilite)
36–Urethane Fat Mat (4")
37–Urethane Fat Mat (8")
38–Urethane Fat Mat (12")
39–Urethane Fat Mat (30")
50–Water
60–Ice
61–Natural
62–Artificial
70–Artificial Surfaces (Outside)
71–Brand Unknown, New*
72–Brand Unknown, Used
73–Astroturf, New*
74–Astroturf, Used
75–Tartanturf, New*
76–Tartanturf, Used
77–Polyturf
78–Superturf, New*
79–Superturf, Used
80–Duraturf, New*
81–Duraturf, Used
82–Outdoor Tartan Track, New*
83–Outdoor Tartan Track, Used
(Inside)
84–Indoor Tartan Surface, New*
85–Indoor Tartan Surface, Used
86–Pro-Gym, New*
87–Pro-Gym, Used
88–Resilient Indoor Surface, Other, New*
89–Resilient Indoor Surface, Other, Used

*New: First three years of installation

Surface Condition
1–Normal
2–Icy
3–Snow-Covered
4–Wet
5–Slippery, Not Wet
6–Muddy
7–Hard
8–Irregular

(Ice Hockey)
1–Normal Ice
2–Used or Old Ice
3–Snow-Covered Ice
4–Soft Ice
5–Irregular Ice

7. SPECIAL INSTRUCTIONS

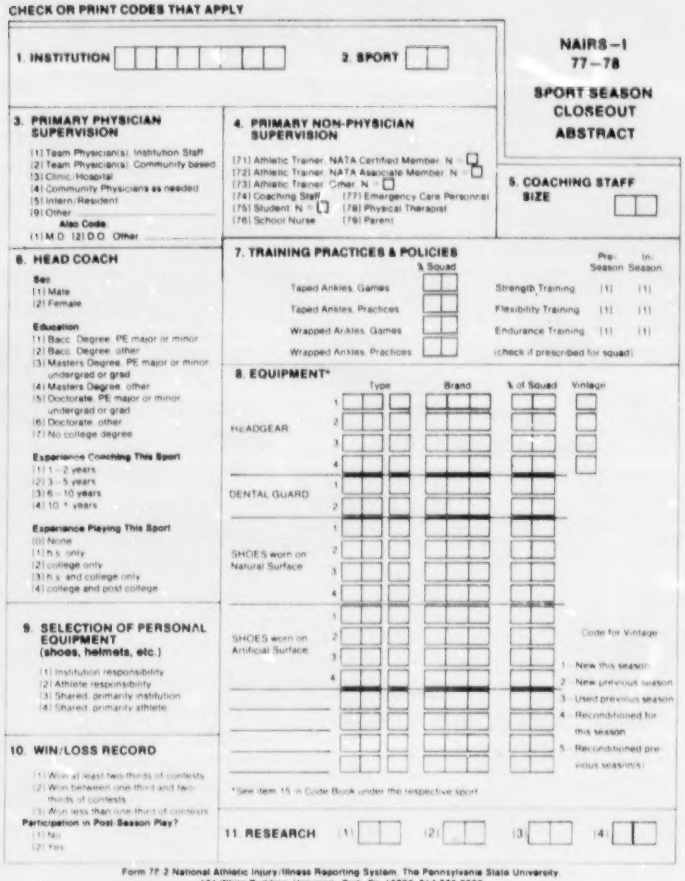
NOTE: for Squad Size/Contest, count only those who competed in the game.
BASEBALL/SOFTBALL: Use number of innings played instead of number of games for Contest Sessions.
FENCING, TENNIS, WRESTLING: Use number of individual matches, not team meets, for Contest Sessions.
VOLLEYBALL: Use number of games played, not matches, for Contest Sessions.

REMARKS

Recorder

Form 78-5 National Athletic Injury/Illness Reporting System, The Pennsylvania State University,
131 White Building, University Park, Pa. 16802, 814-865-9593

APPENDIX E



CHECK OR PRINT CODES THAT APPLY

1. INSTITUTION [ ][ ][ ][ ][ ][ ][ ] 2. SPORT [ ][ ]

NAIRS–1
77–78
SPORT SEASON
CLOSEOUT
ABSTRACT

3. PRIMARY PHYSICIAN SUPERVISION
(1) Team Physician(s): Institution Staff
(2) Team Physician(s): Community based
(3) Clinic/Hospital
(4) Community Physicians as needed
(5) Intern/Resident
(9) Other
Also Code
(1) M.D. (2) D.O. Other

4. PRIMARY NON-PHYSICIAN SUPERVISION
(71) Athletic Trainer, NATA Certified Member. N = [ ]
(72) Athletic Trainer, NATA Associate Member. N = [ ]
(73) Athletic Trainer, Other. N = [ ]
(74) Coaching Staff
(75) Student. N = [ ]
(76) School Nurse
(77) Emergency Care Personnel
(78) Physical Therapist
(79) Parent

5. COACHING STAFF SIZE [ ][ ]

6. HEAD COACH
Sex
(1) Male
(2) Female

Education
(1) Bacc. Degree, PE major or minor
(2) Bacc. Degree, other
(3) Masters Degree, PE major or minor, undergrad or grad
(4) Masters Degree, other
(5) Doctorate, PE major or minor, undergrad or grad
(6) Doctorate, other
(7) No college degree

Experience Coaching This Sport
(1) 1–2 years
(2) 3–5 years
(3) 6–10 years
(4) 10 + years

Experience Playing This Sport
(0) None
(1) h.s. only
(2) college only
(3) h.s. and college only
(4) college and post college

7. TRAINING PRACTICES & POLICIES

	% Squad		Pre-Season	In-Season
Taped Ankles, Games	[ ][ ]	Strength Training	[1]	[1]
Taped Ankles, Practices	[ ][ ]	Flexibility Training	[1]	[1]
Wrapped Ankles, Games	[ ][ ]	Endurance Training	[1]	[1]
Wrapped Ankles, Practices	[ ][ ]	(check if prescribed for squad)		

8. EQUIPMENT*

		Type	Brand	% of Squad	Vintage
HEADGEAR	1	[ ][ ]	[ ][ ][ ]	[ ][ ]	[ ]
	2	[ ][ ]	[ ][ ][ ]	[ ][ ]	[ ]
	3	[ ][ ]	[ ][ ][ ]	[ ][ ]	[ ]
	4	[ ][ ]	[ ][ ][ ]	[ ][ ]	[ ]
DENTAL GUARD	1	[ ][ ]	[ ][ ][ ]	[ ][ ]	
	2	[ ][ ]	[ ][ ][ ]	[ ][ ]	
SHOES worn on Natural Surface	1	[ ][ ]	[ ][ ][ ]	[ ][ ]	
	2	[ ][ ]	[ ][ ][ ]	[ ][ ]	
	3	[ ][ ]	[ ][ ][ ]	[ ][ ]	
	4	[ ][ ]	[ ][ ][ ]	[ ][ ]	
SHOES worn on Artificial Surface	1	[ ][ ]	[ ][ ][ ]	[ ][ ]	
	2	[ ][ ]	[ ][ ][ ]	[ ][ ]	
	3	[ ][ ]	[ ][ ][ ]	[ ][ ]	
	4	[ ][ ]	[ ][ ][ ]	[ ][ ]	
		[ ][ ]	[ ][ ][ ]	[ ][ ]	
		[ ][ ]	[ ][ ][ ]	[ ][ ]	
		[ ][ ]	[ ][ ][ ]	[ ][ ]	
		[ ][ ]	[ ][ ][ ]	[ ][ ]	

Code for Vintage
1 – New this season
2 – New previous season
3 – Used previous season
4 – Reconditioned for this season
5 – Reconditioned previous season(s)

*See item 15 in Code Book under the respective sport

9. SELECTION OF PERSONAL EQUIPMENT (shoes, helmets, etc.)
(1) Institution responsibility
(2) Athlete responsibility
(3) Shared, primarily institution
(4) Shared, primarily athlete

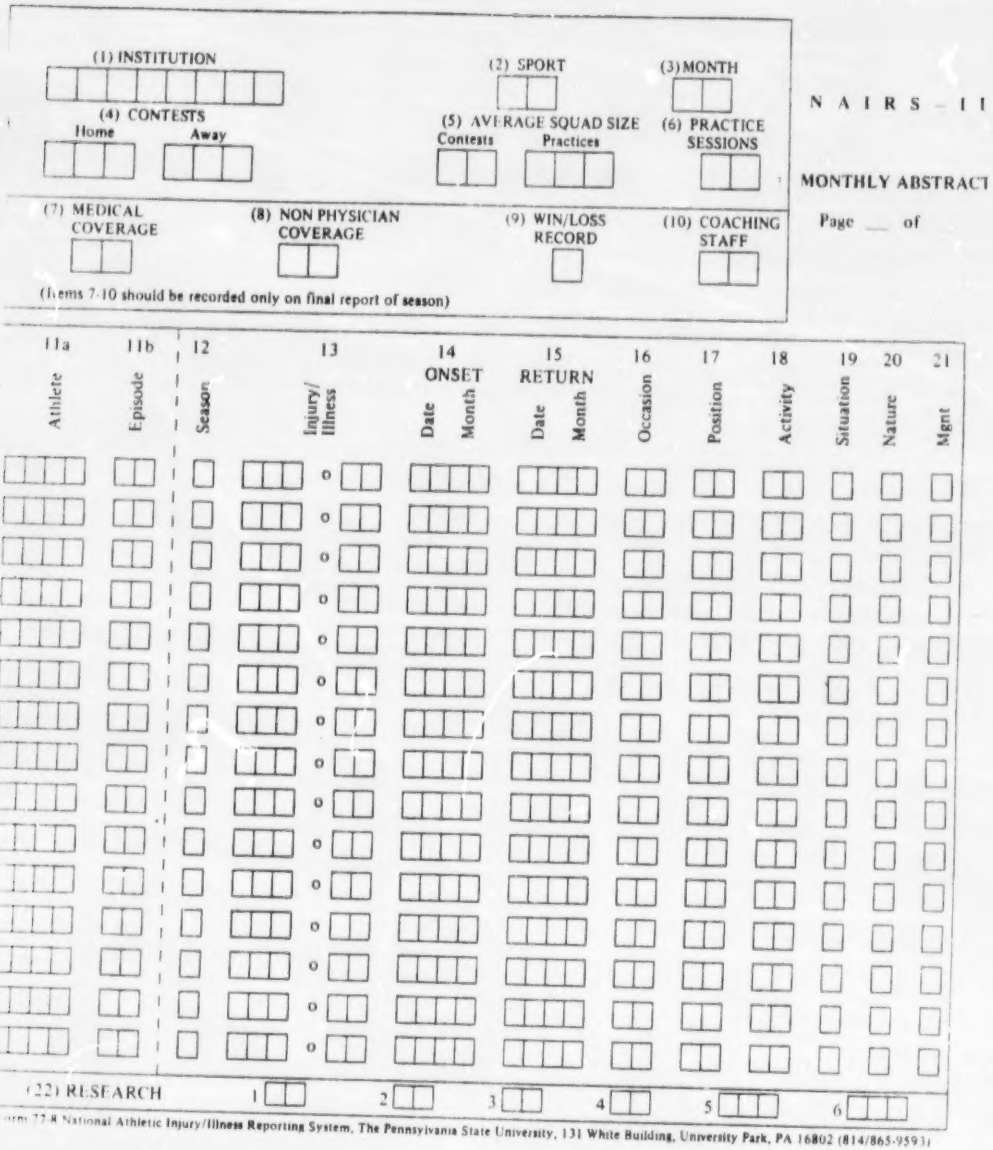
10. WIN/LOSS RECORD
(1) Won at least two-thirds of contests
(2) Won between one-third and two-thirds of contests
(3) Won less than one-third of contests

Participation in Post-Season Play?
(1) No
(2) Yes

11. RESEARCH (1) [ ][ ] (2) [ ][ ] (3) [ ][ ] (4) [ ][ ]

Form 77-2 National Athletic Injury/Illness Reporting System, The Pennsylvania State University
131 White Building, University Park, Pa. 16802, 814-865-9593

APPENDIX F



(1) INSTITUTION

(2) SPORT

(3) MONTH

(4) CONTESTS
Home
Away

(5) AVERAGE SQUAD SIZE
Contests
Practices

(6) PRACTICE SESSIONS

N A I R S – I I

MONTHLY ABSTRACT

Page ___ of

(7) MEDICAL COVERAGE

(8) NON PHYSICIAN COVERAGE

(9) WIN/LOSS RECORD

(10) COACHING STAFF

(Items 7-10 should be recorded only on final report of season)

11a Athlete	11b Episode	12 Season	13 Injury/ Illness	14 ONSET Date	14 ONSET Month	15 RETURN Date	15 RETURN Month	16 Occasion	17 Position	18 Activity	19 Situation	20 Nature	21 Mgnt
			o										
			o										
			o										
			o										
			o										
			o										
			o										
			o										
			o										
			o										
			o										
			o										
			o										
			o										
			o										
			o										

(22) RESEARCH 1 2 3 4 5 6

Form 22-8 National Athletic Injury/Illness Reporting System, The Pennsylvania State University, 131 White Building, University Park, PA 16802 (814/865-9593)

CODES FOR MONTHLY ABSTRACT

(See inside for further explanations)

(4) CONTESTS. Record of number of scheduled and tourney competitive events in which the institution is represented.

(5) AVERAGE SQUAD SIZE:
Contests. Record that which best represents the number of athletes who participated in a competitive event during the season.

Practices. Record that which best represents the number of athletes who participated in a typical practice session during the season.

(6) PRACTICE SESSIONS. Record number of active practice sessions (not skill sessions) conducted during the season.

(7) MEDICAL COVERAGE*

1 – Team Physician, Institution Staff
2 – Team Physician, Community Based
3 – Clinic/Hospital Staff
4 – Community Staff Practitioner
5 – Intern/Resident
9 – Other

*for second digit, add:

1 – M.D.	4 – D.D.S.
2 – D.O.	5 – D.P.M.
3 – D.C.	6 – O.D.

(8) NON-MEDICAL COVERAGE

71 – Athletic Trainer, NATA Certified Member
72 – Athletic Trainer, NATA Associate Member
73 – Athletic Trainer, Other
74 – Coaching Staff
75 – Student Trainer
76 – School Nurse
77 – Emergency Care Person
78 – Physical Therapist
79 – Parent

(9) WIN/LOSS RECORD:

1 – Won at least 2/3rds of contests
2 – Won between 1/3rd and 2/3rds
3 – Won less than 1/3rd of contests

(10) COACHING STAFF. Record number of adult coaches who routinely assist athletes at practice sessions.

(12) SEASON:

1 – Pre-Opener Period
2 – Regular Season
3 – Post-Season Play

(16) OCCASION:

10 – Not Sport-Related
11 – Residence
12 – Vehicle, Passenger
13 – Vehicle, Pedestrian
14 – School, not sport/phys ed
15 – Job
16 – Public, Other

2@ – Varsity Sports
20 – Competition, Home
21 – Competition, Away
22 – Team Travel, Vehicle
23 – Team Travel, Other
24 – Locker/Shower/Training Room
25 – Between Lockerroom/Arena
26 – Practice/Skill Training
27 – Practice/Conditioning
28 – Practice/Scrimmage
29 – Practice/Contest

3@ – Sub-Varsity Sports

4@ – Club Sports

5@ – Intramural Sports

6@ – Physical Education

(20) NATURE:

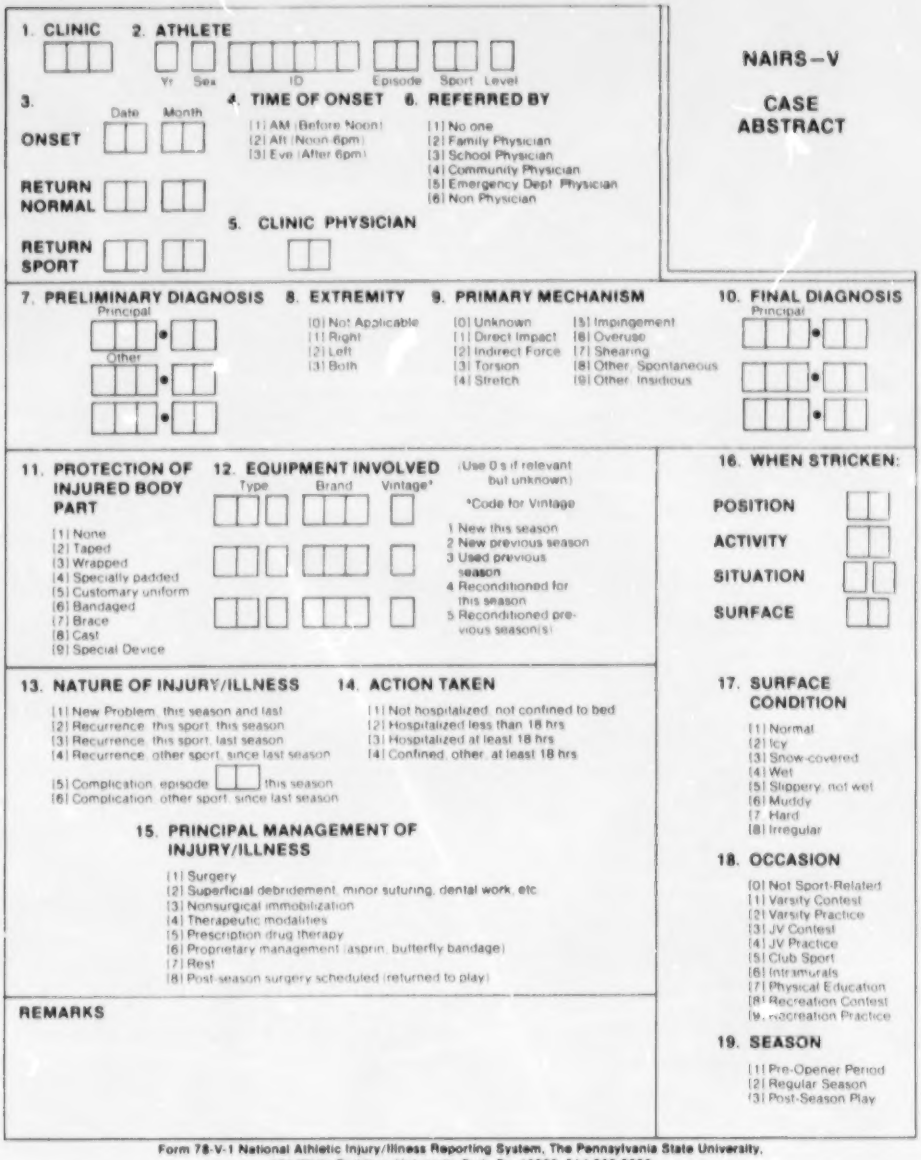
1 – New Injury, this season or last
2 – Recurrence, this season or last
5 – Complication of previous injury

(21) MANAGEMENT: (select principal one)

1 – Surgery
2 – Superficial Debridement, minor suturing, etc.
3 – Nonsurgical Immobilization
4 – Formal physical therapy
5 – Prescription drug therapy
6 – Proprietary management (aspirin)
7 – Rest
8 – Post-season surgery scheduled

* see second digit in 20 series

APPENDIX G



1. CLINIC 2. ATHLETE
Yr Sex ID Episode Sport Level

NAIRS–V

CASE ABSTRACT

3. ONSET Date Month

RETURN NORMAL

RETURN SPORT

4. TIME OF ONSET
[1] AM (Before Noon)
[2] Aft (Noon-6pm)
[3] Eve (After 6pm)

5. CLINIC PHYSICIAN

6. REFERRED BY
[1] No one
[2] Family Physician
[3] School Physician
[4] Community Physician
[5] Emergency Dept. Physician
[6] Non Physician

7. PRELIMINARY DIAGNOSIS
Principal
Other

8. EXTREMITY
[0] Not Applicable
[1] Right
[2] Left
[3] Both

9. PRIMARY MECHANISM
[0] Unknown
[1] Direct Impact
[2] Indirect Force
[3] Torsion
[4] Stretch
[5] Impingement
[6] Overuse
[7] Shearing
[8] Other, Spontaneous
[9] Other, Insidious

10. FINAL DIAGNOSIS
Principal

11. PROTECTION OF INJURED BODY PART
[1] None
[2] Taped
[3] Wrapped
[4] Specially padded
[5] Customary uniform
[6] Bandaged
[7] Brace
[8] Cast
[9] Special Device

12. EQUIPMENT INVOLVED (Use 0's if relevant but unknown)
Type Brand Vintage*

*Code for Vintage
1 New this season
2 New previous season
3 Used previous season
4 Reconditioned for this season
5 Reconditioned previous season(s)

16. WHEN STRICKEN:
POSITION
ACTIVITY
SITUATION
SURFACE

13. NATURE OF INJURY/ILLNESS
[1] New Problem, this season and last
[2] Recurrence, this sport, this season
[3] Recurrence, this sport, last season
[4] Recurrence, other sport, since last season
[5] Complication, episode ___ this season
[6] Complication, other sport, since last season

14. ACTION TAKEN
[1] Not hospitalized, not confined to bed
[2] Hospitalized less than 18 hrs
[3] Hospitalized at least 18 hrs
[4] Confined, other, at least 18 hrs

15. PRINCIPAL MANAGEMENT OF INJURY/ILLNESS
[1] Surgery
[2] Superficial debridement, minor suturing, dental work, etc.
[3] Nonsurgical immobilization
[4] Therapeutic modalities
[5] Prescription drug therapy
[6] Proprietary management (asprin, butterfly bandage)
[7] Rest
[8] Post-season surgery scheduled (returned to play)

17. SURFACE CONDITION
[1] Normal
[2] Icy
[3] Snow-covered
[4] Wet
[5] Slippery, not wet
[6] Muddy
[7] Hard
[8] Irregular

18. OCCASION
[0] Not Sport-Related
[1] Varsity Contest
[2] Varsity Practice
[3] JV Contest
[4] JV Practice
[5] Club Sport
[6] Intramurals
[7] Physical Education
[8] Recreation Contest
[9] Recreation Practice

19. SEASON
[1] Pre-Opener Period
[2] Regular Season
[3] Post-Season Play

REMARKS

Form 78-V-1 National Athletic Injury/Illness Reporting System, The Pennsylvania State University, 131 White Building, University Park, Pa. 16802, 814-865-9593

NAIRS–V CASE ABSTRACT (Cont'd: Personal Characteristics)

20. ☐☐ AGE (Use nearest age)

21. HEIGHT

[1] less than 5 0
[2] 5 0 – 5 3
[3] 5 4 – 5 7
[4] 5 8 – 5 11
[5] 6 0 – 6 3
[6] 6 4 – 6 7
[7] 6 8 – 6 11
[8] 7 0 +

22. WEIGHT

[1] less than 112
[2] 112 – 124
[3] 125 – 139
[4] 140 – 154
[5] 155 – 169
[6] 170 – 189
[7] 190 – 209
[8] 210 – 234
[9] 235 +

23. ☐☐ EDUCATION (Year in School)

(00 = not in school, 09 = 9th grade, 13 = 1st year College)

24. EXPERIENCE (Years under Formal Coaching, this sport, including this season.)

[1] 1 year
[2] 2 – 3 years
[3] 4 – 5 years
[4] 6 – 10 years
[5] 11 + years

25. PERFORMANCE RATING

[1] Starter (expected to *start* every game)
[2] Regular (expected to *play* in every game even if not a starter)
[3] Substitute (not expected to play in every game)

26. RESEARCH

a ☐☐ b ☐☐ c ☐☐ d ☐☐ e ☐☐ f ☐☐

☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐

APPENDIX H

```
    VAIAS ACTIVITY REPORT FOR PERIOD        07/01/76 TO 10/11/76
INSTITUTION/CLUB CODE/SPO                   DATE    10/11/76  PAGE 0011

**********CASE ABSTRACT**********
SPORT                   (05)        FOOTBALL
PARTICIPANT                         1355
EPISODE                             01
DATE OF ONSET                       MONTH=07  DAY=12
DATE OF RETURN                      MONTH=07  DAY=14
TIME OF ONSET           (1)         MORNING
SEASON                  (1)         PRE-SEASON PERIOD
DIAGNOSIS               (113111)    ACROMIOCLAVICULAR SPRAIN, 1ST DG
EXTREMITY               (1)         RIGHT
PRIMARY MECHANISM       (1)         DIRECT IMPACT
OCCASION                (25)        VARSITY SPORT
                                    PRACTICE/SKILL TRAINING
SOURCE OF DIAGNOSIS     (71)        ATHLETIC TRAINER,NATA CERT MEM
POSITION                (41)        SAFETY
ACTIVITY                (80)        UNINTENDED COLLISION
SITUATION               (42)        BLOCKING DRILLS NO EQUIPMENT
                                    2ND FOURTH OF PRACTICE
SURFACE                 (11)        GRASS
PROTECTION OF I & P     (5)         CUSTOMARY UNIFORM
CLIMATE CONDITION       (5)         HOT, LOW HUMIDITY
EQUIPMENT INVOLVED
        TYPE            (270)       SHOULDER PADS,CANTILEVER
        BRAND           (043)       WILSON SPORTING GOODS CO.
        VINTAGE         (1)         USED PREVIOUS SEASON
NATURE OF ILL / INJ     (1)         NEW PROBLEM,THIS SPORT-SEASON
ACTION TAKEN            (1)         NOT HOSPIT,NOT CONFINED TO BED
PRINCIPAL MANAGEMENT    (4)         FORMAL PHYSICAL THERAPY

**********CASE ABSTRACT**********
SPORT                   (05)        FOOTBALL
PARTICIPANT                         1068
EPISODE                             01
DATE OF ONSET                       MONTH=09  DAY=23
DATE OF RETURN                      MONTH=08  DAY=31
TIME OF ONSET           (3)         EVENING
SEASON                  (1)         PRE-SEASON PERIOD
DIAGNOSIS               (743221)    ANKLE SPRAIN, DELTOID LIG,2ND DG
EXTREMITY               (1)         RIGHT
PRIMARY MECHANISM       (2)         INDIRECT FORCE
OCCASION                (29)        VARSITY SPORT
                                    PRACTICE/CONTEST
SOURCE OF DIAGNOSIS     (11)        TEAM M.D., INSTITUTION STAFF
POSITION                (62)        OFFENSIVE GUARD
ACTIVITY                (33)        PILE-ON WHILE BLOCKING
SITUATION               (14)        RUNNING PLAY INSIDE TACKLE
                                    4TH QUARTER
SURFACE                 (42)        ASTROTURF, > 3 YRS OLD
PROTECTION OF I & P     (2)         TAPED
CLIMATE CONDITION       (6)         HOT, MODERATE HUMIDITY
EQUIPMENT INVOLVED
        TYPE            (640)       SHOES,LOWCUT,MULTICLEATS
        BRAND           (367)       BRADLEY SHOE CO.
        VINTAGE         (2)         NEW PREVIOUS SEASON
NATURE OF ILL / INJ     (1)         NEW PROBLEM,THIS SPORT-SEASON
ACTION TAKEN            (1)         NOT HOSPIT,NOT CONFINED TO BED
PRINCIPAL MANAGEMENT    (3)         NONSURGICAL IMMOBILIZATION
```

NAIRS INJURY/ILLNESS SUMMARY

SPORT: FOOTBALL, FALL (M) LEVEL: COL/UNIVERSITY DATE: 01/26/79

NUMBER OF INSTITUTIONS REPORTING: 69

	ALL INSTITUTIONS
AVERAGE CONTEST SQUAD	49
NUMBER OF CONTESTS	743
AVERAGE PRACTICE SQUAD	92
NUMBER OF PRACTICES	5289
AVERAGE PRACTICE/CONTEST SQUAD	69
NUMBER OF PRACTICE/CONTEST	146
TOTAL EXPOSURES	531,798

TABLE I SUMMARY OF CASES EXPERIENCED (END OF 1979 SEASON)

		TOTAL VARSITY	VARSITY CONTEST	VARSITY PRACTICE	VARSITY PRACTICE CONTEST	VARSITY MISC & J.V.	*	OTHER SPORTS	NON SPORT	**	TOTAL VARSITY CASES PER 1000 EXPOSURES	COEFFICIENT OF VARIATION
(MINOR CASES)												
ALL INSTITUTIONS	N=	4253	1559	2583	58	155		21	520			
ALL INSTITUTIONS	R=	67.2	46.2	40.8	1.2	2.4		0.3	10.9		7.997	61.63
(SIGNIFICANT CASES)												
ALL INSTITUTIONS	N=	1557	655	847	46	74		19	114			
ALL INSTITUTIONS	R=	24.6	19.4	13.4	1.0	1.2		0.3	2.4		2.928	44.13
(MAJOR CASES)												
ALL INSTITUTIONS	N=	648	284	341	20	30		12	84			
ALL INSTITUTIONS	R=	10.2	8.4	5.4	0.4	0.5		0.2	0.9		1.219	51.14
(SEVERE CASES)												
ALL INSTITUTIONS	N=	0	0	0	0	0		0	1			
ALL INSTITUTIONS	R=	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.000	0.00

N = NUMBER OF CASES REPORTED
R = RATE PER 100 ATHLETES
NOTE: FOR VARSITY COMPETITION, AVERAGE CONTEST SQUAD IS USED
FOR VARSITY PRACTICE/COMPETITION, AVERAGE PRACTICE/CONTEST SQUAD IS USED
ALL OTHER RATES USE THE AVERAGE PRACTICE SQUAD SIZE

MINOR CASE = ANY REPORTABLE INJURY/ILLNESS (OTHER THAN DENTAL INJURIES) WHICH DID NOT KEEP AN ATHLETE FROM PARTICIPATION LONGER THAN ONE WEEK
SIGNIFCANT CASE = ANY INJURY/ILLNESS THAT KEPT AN ATHLETE FROM PARTICIPATION LONGER THAN ONE WEEK PLUS DENTAL INJURIES REGARDLESS OF TIME LOSS.
MAJOR CASE = ANY SIGNIFICANT INJURY/ILLNESS THAT KEPT AN ATHLETE FROM PARTICIPATION LONGER THAN THREE WEEKS.
SEVERE CASE = ANY SIGNIFICANT INJURY/ILLNESS CAUSING SOCIETALLY SERIOUS DISABILITY (E.G. DEATH QUADRIPLEGIA,AMPUTATION).

INSTITUTION: SUMMARY SPORT: FOOTBALL, FALL (M) LEVEL: COL/UNIVERSITY DATE: 03/14/78

TABLE II: SUMMARY OF CASES EXPERIENCED (END OF 1977 SEASON)
GAME RELATED - BODY PART APPEARED BY POSITION

		QUARTER-BACK	RUNNING BACK	WIDE RECEIVER	OFF. INT. LINEMAN	TIGHT END	LINE-BACKER	SECONDARY	DEF. LINEMAN	KICKING UNITS	NON-PARTI-CIPANT	CASE RATE/ 1000 ATH-EXP
HEAD-NECK-SPINE INJ												
ALL INSTITUTIONS	N=	1	6	1	6	2	6	8	12	5	0	47
	%=	2	13	2	13	4	13	17	26	11	0	1.28
FACE-SCALP INJURIES												
ALL INSTITUTIONS	N=	1	2	0	0	0	2	1	3	5	0	14
	%=	7	14	0	0	0	14	7	21	36	0	0.38
SHOULDER-ARM INJ												
ALL INSTITUTIONS	N=	5	12	5	8	3	9	12	13	14	0	80
	%=	6	15	6	10	2	11	15	16	17	0	2.20
FOREARM-HAND INJ												
ALL INSTITUTIONS	N=	4	6	2	6	1	5	5	9	7	0	45
	%=	9	13	4	13	2	11	11	20	16	0	1.24
TORSO INJURIES												
ALL INSTITUTIONS	N=	7	5	3	6	2	5	3	5	2	0	37
	%=	19	14	8	16	5	14	8	14	5	0	1.01
HIP-LEG INJURIES												
ALL INSTITUTIONS	N=	0	11	4	6	3	5	14	10	16	0	69
	%=	0	16	6	9	4	7	20	14	23	0	1.89
KNEE INJURIES												
ALL INSTITUTIONS	N=	10	31	9	43	4	37	28	60	37	0	250
	%=	4	12	4	17	2	15	7	24	15	0	6.87
FOOT-ANKLE INJURIES												
ALL INSTITUTIONS	N=	9	16	2	14	2	13	16	29	9	0	110
	%=	8	15	2	13	2	12	15	26	8	0	3.02
DISC CONDITIONS												
ALL INSTITUTIONS	N=	0	0	0	0	0	1	0	1	0	0	2
	%=	0	0	0	0	0	50	0	50	0	0	0.05
ALL CASES												
ALL INSTITUTIONS	N=	37	89	26	89	16	83	76	162	95	0	654
	%=	6	14	4	14	2	13	12	22	15	0	17.96

APPENDIX J

INSTITUTION: SUMMARY SPORT: FOOTBALL, FALL (M) LEVEL: COL/UNIVERSITY DATE: 03/14/78

TABLE III: SUMMARY OF CASES EXPERIENCED (END OF 1977 SEASON)
GAME RELATED - BODY PART AFFECTED BY SITUATION

		RUN PLAY, INSIDE TACKLE	RUN PLAY, OUTSIDE TACKLE	PASS PLAY	BROKEN PLAY, FUMBLE	BROKEN PLAY, INTERCEPTION	PUNT PLAY	FIELD GOAL ATTEMPT	POINT AFTER TD	KICKOFF	UNKNOWN	CASE RATE/ 1000 ATH-EXP
HEAD-NECK-SPINE INJ												
ALL INSTITUTIONS	N=	16	16	7	0	0	1	1	0	3	3	47
	%=	34	34	15	0	0	2	2	0	6	6	1.28
FACE-SCALP INJURIES												
ALL INSTITUTIONS	N=	2	3	3	0	0	1	0	0	4	1	14
	%=	14	21	21	0	0	7	0	0	29	7	0.36
SHOULDER-ARM INJ												
ALL INSTITUTIONS	N=	16	27	18	0	1	6	1	0	7	4	80
	%=	20	34	22	0	1	7	1	0	9	5	2.20
FOREARM-HAND INJ												
ALL INSTITUTIONS	N=	10	15	9	0	1	1	0	1	5	3	45
	%=	22	33	20	0	2	2	0	2	11	7	1.24
TORSO INJURIES												
ALL INSTITUTIONS	N=	6	11	14	0	1	1	0	0	1	3	37
	%=	16	30	38	0	3	3	0	0	3	8	1.01
HIP-LEG INJURIES												
ALL INSTITUTIONS	N=	16	20	12	0	0	5	0	1	10	5	69
	%=	23	29	17	0	0	7	0	1	14	7	1.89
KNEE INJURIES												
ALL INSTITUTIONS	N=	64	81	50	4	3	16	2	3	14	13	250
	%=	26	32	20	2	1	6	1	1	6	5	6.87
FOOT-ANKLE INJURIES												
ALL INSTITUTIONS	N=	33	39	22	2	2	5	0	1	3	3	110
	%=	30	35	20	2	2	5	0	1	3	3	3.02
DISC CONDITIONS												
ALL INSTITUTIONS	N=	0	1	0	0	0	0	0	0	0	1	2
	%=	0	50	0	0	0	0	0	0	0	50	0.05
ALL CASES												
ALL INSTITUTIONS	N=	163	213	135	6	8	36	4	6	47	36	654
	%=	25	33	21	1	1	6	1	1	7	6	17.96

INSTITUTION: SUMMARY SPORT: FOOTBALL, FALL (B) LEVEL: COL/UNIVERSITY DATE: 03/14/78

TABLE IV: SUMMARY OF CASES EXPERIENCED (END OF 1977 SEASON)
SPORT RELATED - BODY PART AFFECTED BY ACTIVITY CATEGORY

		TACKLING	BEING TACKLED	BLOCKING	BEING BLOCKED	UNINTENT. COLLISION	OTHER (NO CONTACT)	UNKNOWN	CASE RATE/ 1000 ATH-EXP
HEAD-NECK-SPINE INJ									
ALL INSTITUTIONS	N=	36	19	24	13	2	4	5	103
	%=	35	18	23	13	2	4	5	0.18
FACE-SCALP INJURIES									
ALL INSTITUTIONS	N=	8	10	5	11	2	1	3	41
	%=	20	24	12	27	5	2	7	0.08
SHOULDER-ARM INJ									
ALL INSTITUTIONS	N=	54	53	40	20	10	18	8	203
	%=	27	26	20	10	5	9	4	0.38
FOREARM-HAND INJ									
ALL INSTITUTIONS	N=	34	19	29	12	8	10	5	117
	%=	29	16	25	10	7	9	4	0.21
TORSO INJURIES									
ALL INSTITUTIONS	N=	11	24	16	19	2	14	7	93
	%=	12	26	17	20	2	15	8	0.17
HIP-LEG INJURIES									
ALL INSTITUTIONS	N=	29	32	26	29	4	85	10	215
	%=	13	15	12	13	2	40	5	0.40
KNEE INJURIES									
ALL INSTITUTIONS	N=	75	101	109	143	27	74	26	557
	%=	13	18	20	26	5	13	5	1.05
FOOT-ANKLE INJURIES									
ALL INSTITUTIONS	N=	45	51	57	54	11	56	11	286
	%=	16	18	20	19	4	20	4	0.53
MISC CONDITIONS									
ALL INSTITUTIONS	N=	1	0	0	1	0	3	2	7
	%=	14	0	0	14	0	43	29	0.00
ALL CASES									
ALL INSTITUTIONS	N=	293	309	306	302	66	265	77	1622
	%=	18	19	19	19	4	16	5	3.07

APPENDIX L

INSTITUTION: SUMMARY SPORT: FOOTBALL, FALL (M) LEVEL: COL/UNIVERSITY DATE: 02/02/79

TABLE V: SIGNIFICANT SPORT-RELATED CASES (END OF 1977 SEASON)

GENERAL CONDITION FREQUENCY BY ACTIVITY WHEN STRICKEN 00011250

		TACKLING	BEING TACKLED	BLOCKING	BEING BLOCKED	UNINTENT. COLLISION	OTHER (NO CONTACT)	UNKNOWN	CASE RATE/ 1000 ATH-EXP
GENERAL TRAUMA									
ALL INSTITUTIONS	N=	42	66	43	59	10	37	17	274
	%=	15	24	16	22	4	14	6	0.50
NEUROTRAUMA									
ALL INSTITUTIONS	N=	28	12	15	8	2	4	1	73
	%=	38	16	21	11	3	5	5	0.12
BONES									
ALL INSTITUTIONS	N=	0	0	0	0	0	2	0	2
	%=	0	0	0	0	0	100	0	0.00
SPRAIN									
ALL INSTITUTIONS	N=	147	179	168	184	41	95	24	842
	%=	17	21	20	22	5	11	3	1.57
STRAIN									
ALL INSTITUTIONS	N=	36	18	34	11	2	91	6	198
	%=	18	9	17	6	1	46	3	0.37
FRACTURE									
ALL INSTITUTIONS	N=	36	29	39	36	10	21	13	184
	%=	20	16	21	20	5	11	7	0.34
MUSCULO-SKELETAL									
ALL INSTITUTIONS	N=	3	4	5	4	1	11	6	34
	%=	9	12	15	12	3	32	18	0.06
CHEMICAL ILLNESS									
ALL INSTITUTIONS	N=	0	0	0	0	0	0	0	0
	%=	0	0	0	0	0	0	0	0.00
GENERAL ILLNESS									
ALL INSTITUTIONS	N=	2	0	2	1	0	4	6	15
	%=	13	0	13	7	0	27	40	0.02
SEVERE DISABILITY									
ALL INSTITUTIONS	N=	0	0	0	0	0	0	0	0
	%=	0	0	0	0	0	0	0	0.00
ALL CASES									
ALL INSTITUTIONS	N=	294	308	306	303	66	265	76	1622
	%=	18	19	19	19	4	16	5	3.04

APPENDIX N

HIGH SCHOOL FOOTBALL PARTICIPATION (1976-1978)

Institution	Head Trainer
Amelia High School	Charles Burns
Bowie High School	Richard S. Voss, Jr.
Boyertown Area High School	Dennis J. Stephen
Carl Sandberg High School	John A. Wator
Cary Grove High School	Gil Gulbrandson
Clay Battelle High School	Robert Antion
Columbia High School	Jack Meunchen
Columbia Senior High School	Ronald E. Linfonte
Cumberland Valley High School	Robert H. Shank
Curie High School	Gene Zaja
Ephrata High School	David L. Wood
The Episcopal Academy	Thomas J. Murphy
Fenwick High School	Robert Vanoer
Floyd Central High School	Glen R. Snow
Forest View High School	Ron Freeman
Fremont Ross High School	Glen R. Foster
Garner Senior High School	William R. Moore
Grimsley High School	Robert F. Mays
Hunterdon Central High School	Richard H. Schaefer
J. F. Webb High School	David Jenks
James Madison High School	Mike Petty
Jenkintown High School	Rich Stetler
John A. Wilkinson High School	John Britt
Lake Braddock Secondary School	Richard Isaac
Luther High School, North	Richard Miller
Lyons Township High School	Rich Carey
Madison-Mayoden High School	Gilbert McKee
Mt. Everett Regional High School	Robert Duchardt
New Albany High School	Don Ogle
North Buncombe High School	Russell McEntire
North Country Union High School	Brian Hampton
North Duplin High School	George Summerlin
Olympic Senior High School	Elton G. Hawley
Palo-Verde High School	Lynn C. Bott
Port-Neches Groves High School	David Fendley
Ragsdale High School	Mike Raybon
Rockingham County High School	Bob Gentry
Shady Side Academy	Mike Mooney
Solomon-Juneau High School	John Schmitz
South Mecklinburg High School	R. Scott Douglass
State College Area High School	John Miller/Lin D. Persia
Sunnyside High School	Darry Voigt
Thomas Jefferson High School	Michael Biles
W. A. Berry High School	Wayne M. Kendrick
Wake Forest Rolesville High School	Bob Ford
Walter Hines Page High School	John Schneider
West Forsyth Senior High School	Edward R. Sugg

APPENDIX O

COLLEGE FOOTBALL PARTICIPATION (1976-1978)

Institution	Head Athletic Trainer
Alabama, University of	Jim Goostree
Appalachian State University	Ron Kanoy
Arizona State University	Ray Robison
Arizona, University of	Warren Lee
Ashland College	Gary Lake
Bloomsburg State College	Paul G. Slocum
Boston State College	Mark Doughtie
Brown University	Joanne Dolcemaschio
California State University, Hayward	Don Chu
California State University, Long Beach	Dan Bailey
California State University, Sacramento	Gerald W. Bell
California, University of (Berkley)	Robert Orr
California, University of (Los Angeles)	Larry Carter
Central Michigan University	Kenneth Kopke
Cincinnati, University of	Bill Walker
Delaware, University of	C. Roy Rylander, Teresa Cioffredi
Duke University	J. Michael Ritz
East Carolina University	Rod Compton
East Tennessee State University	Jerry L. Robertson
Eastern Illinois University	Dennis Aten, Robert Bruns
Elmhurst College	Mike Barnish
Florida, University of	Chris Patrick
Georgia Tech	Bill McDonald
Georgia, University of	Warren Morris
Gettysburg College	John Goff, Gareth Biser
Gustavus Adolphus State College	Gary Reinholtz
Idaho, University of	Mark J. Smaha
Illinois State University	Geraldine Greenlee
Illinois, University of	John Pickering
Indiana State University	Ray Baggett
Indiana University of Pa.	Vic Lincinsky
Indiana University	Brian Lewis, John Schrader
Iowa State University	Frank Randall
Iowa, University of	Ed Crowley, Dan Foster
Ithaca College	Kent Scriber
Kentucky, University of	Roy Don Wilson
Lamar University	Paul Zeek
Lehigh University	Charles McNaron
Lock Haven State College	David J. Tomasi
Louisiana Tech University	W. S. Bundrick, Wendall Garrett
McNeese State University	James T. Murphy
Mankato State University	Gordon L. Graham
Miami University of Ohio	Ken Wolfert
Michigan State University	Clint Thompson
Michigan, University of	Al Green
Minnesota, University of	Jim Marshall
Mississippi, University of	Leroy Mullins

APPENDIX O (CONT'D)

COLLEGE FOOTBALL PARTICIPATION (1976-1978)

Institution	Head Athletic Trainer
Montana State University	Chuck Kernap
Murray State University	Tom Simmons
Nebraska, University of	Kennis Sealey
New York, State University of at Cortland	John Sciera
New York, State University of at Plattsburg	Hollis W. Powers
North Dakota State University	Denis Isrow
North Dakota, University of	A. G. Edwards
Northern Colorado, University of	Dan Libera
Northwestern University	Tom Oxley, Tippy Dye
Ohio State University	Bill Hill, Charles Chartier
Ohio University	Skip Vosler
Oregon State University	Richard Irvin, Bill Robertson
Oregon, University of	Larry Standifer
Ottawa, University of (CANADA)	Bill Morrison/Robert Pelletier
The Pennsylvania State University	James Whiteside
Pittsburgh, University of	James Irrgang, Tim Kerin
Purdue University	William Newell, Dennis Miller
Queens University (CANADA)	Ken Gow
Royal Military College (CANADA)	Pat Clayton
St. Cloud State College	Kent Kalm
San Diego, University of	Larry Roberts
Slippery Rock State College	Richard McCandless
South Dakota State University	Jim Boober
Southern Colorado, University of	Karl Klinksiek
Southern Mississippi, University of	E. L. Harrington
Springfield College	Charles J. Redmond
Stanford University	Dave Blanchard
Temple University	Ted Quedenfeld, Joseph Vegso, William Prentice
Tennessee, University of	Tim Kerin
Trenton State College	Joseph Camillone
Utah State University	Dale Mildenberger
Vanderbilt University	Jack Redgren
Washington State University	Kick Melhart
Washington, University of	Don Labourr
West Chester State College	Phil Donley
West Virginia State University	John C. Spiker
Western Illinois University	Roland LaRue, Jerry Weber
Wilmington College	Roger Tewksbury
Wisconsin, University of	Brad Sherman
Wyoming, University of	Eddie Day
Yale University	Peter Jokl, M.D.

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